Date Submitted: <u>5/31/07</u> Originator: <u>L. M. Dittmer</u> Phone: <u>372-9227</u>	WASTE SITE RECLASSIFICATION FORM Operable Unit(s): <u>100-BC-2</u> Waste Site Code: <u>100-C-9:1</u> Type of Reclassification Action: Closed Out ☐ Interim Closed Out ☒ No Action ☐ RCRA Postclosure ☐ Rejected ☐ Consolidated ☐	Control Number: <u>2004-012</u>
--	---	---------------------------------

This form documents agreement among parties listed authorizing classification of the subject unit as Closed Out, Interim Closed Out, No Action, RCRA Postclosure, Rejected, or Consolidated. This form also authorizes backfill of the waste management unit, if appropriate, for Closed Out and Interim Closed Out units. Final removal from the NPL of No Action and Closed Out waste management units will occur at a future date.

Description of current waste site condition:

The 100-C-9:1 main process sewer pipeline, also known as the twin box culvert, was a dual reinforced process sewer that collected process effluent from the 183-C and 190-C water treatment facilities, discharging at the 132-C-2 Outfall. For remedial action purposes, the 100-C-9:1 waste site was subdivided into northern and southern sections. Remedial actions and verification sampling of both the northern and southern sections have been completed. Where contamination within the 100-C-9:1 twin box culvert existed in the shallow zone (i.e., < 4.6 m [15 ft] below ground surface) the concrete of the culvert and a minimum of 0.3 m (1 ft) of underlying soil has been removed and disposed at the Environmental Restoration Disposal Facility (ERDF). Evaluation of samples collected from within the twin box culvert and from soils underlying the culvert support leaving the structure in place where it exists in the deep zone (i.e., > 4.6 m [15 ft] below ground surface). Evaluation of the current condition of the 100-C-9:1 waste site supports a reclassification to Interim Closed Out. The evaluation of the 100-C-9:1 waste site involved using historical information, field observations, and analytical data from samples collected from the site.

Evaluation, remediation, and verification sampling of this site has been performed in accordance with remedial action objectives and remedial action goals established by the *Interim Action Record of Decision for the 100-BC-1, 100-BC-2, 100-DR-1, 100-DR-2, 100-FR-1, 100-FR-2, 100-HR-1, 100-HR-2, 100-KR-1, 100-KR-2, 100-IU-2, 100-IU-6, and 200-CW-3 Operable Units, Hanford Site, Benton County, Washington*, U.S. Environmental Protection Agency, Region 10, Seattle, Washington (Remaining Sites ROD).

Basis for reclassification:

The 100-C-9:1 subsite has been remediated to achieve the remedial action objectives specified in the Remaining Sites ROD. The results of verification sampling demonstrated that residual contaminant concentrations do not preclude any future uses (as bounded by the rural-residential scenario) and allow for unrestricted use of shallow zone soils (i.e., surface to 4.6 m [15 ft] deep). The results also showed that residual contaminant concentrations are protective of groundwater and the Columbia River. The suitability of direct exposure to deep zone soils has not been demonstrated, and institutional controls are required to prevent uncontrolled drilling or excavation into the deep zone. The basis for reclassification is described in detail in the *Remaining Sites Verification Package for the 100-C-9:1 Main Process Sewer Collection Line* (attached).

Waste Site Controls:

Engineered Controls: Yes ☐ No ☒ Institutional Controls: Yes ☒ No ☐ O&M requirements: Yes ☐ No ☒
 If any of the Waste Site Controls are checked Yes specify control requirements including reference to the Record of Decision, TSD Closure Letter, or other relevant documents.

Institutional controls are required to prevent uncontrolled drilling or excavation into the deep zone, as specified in the Remaining Sites ROD and in the *Remaining Sites Verification Package for the 100-C-9:1 Main Process Sewer Collection Line* (attached).

K. D. Bazzell DOE Federal Project Director (printed)	Signature	<u>6/6/07</u> Date
N/A Ecology Project Manager (printed)	 Signature	 Date
D. A. Faulk EPA Project Manager (printed)	Signature	<u>6/11/07</u> Date

**REMAINING SITES VERIFICATION PACKAGE FOR THE
100-C-9:1 MAIN PROCESS SEWER COLLECTION LINE**

Attachment to Waste Site Reclassification Form 2004-012

June 2007

REMAINING SITES VERIFICATION PACKAGE FOR THE 100-C-9:1 MAIN PROCESS SEWER COLLECTION LINE

EXECUTIVE SUMMARY

The 100-C-9:1 Main Process Sewer Collection Line is located within the 100-BC-2 Operable Unit in the 100-B/C Area of the Hanford Site. The 100-C-9:1 Main Process Sewer Collection Line is one of four subsites associated with 100-C-9 and is the only subsite discussed in this report.

The 100-C-9:1 subsite consists of the main process sewer collection line, also known as the twin box culvert, and the feeder pipelines from the 100-C water treatment facilities. Confirmatory sampling of 100-C-9:1 was conducted in September and October 2003 to determine if remedial action was necessary at the site. An evaluation of the confirmatory sample results indicated that elevated concentrations of hexavalent chromium and mercury in the twin box culvert scale and elevated hexavalent chromium in the underlying soil required remediation (remove, treat, dispose) wherever the 100-C-9:1 contamination was in the shallow zone (i.e., surface to 4.6 m [15 ft] deep). Due to the size of the required excavation, the 100-C-9:1 waste site was divided into a northern and a southern section.

Remedial action of the northern portion of the 100-C-9:1 site was initiated on November 22, 2004, and continued into February 2005. The entire northern section of the 100-C-9:1 twin box culvert was excavated along with a minimum of 0.3 m (1 ft) of underlying soil. Approximately 14,639 metric tons (16,137 U.S. tons) of contaminated soil and concrete were removed for disposal to the Environmental Restoration Disposal Facility (ERDF). Verification sampling of the northern excavation was performed August 23, 2005.

The southern portion of the 100-C-9:1 waste site consisted of a deep zone (i.e., more than 4.6 m [15 ft] deep) section of the twin box culvert and a shallow zone which included a section of the twin box culvert and the feeder lines from the 100-C water treatment facilities. Remediation of the shallow zone of the southern portion of the 100-C-9:1 site was initiated in December 2004, and completed on April 19, 2006. Approximately 5,851 metric tons (6,450 U.S. tons) of contaminated soil and concrete were removed for disposal to ERDF. The deep zone portion of the southern twin box culvert was left in place. Verification sampling of the southern excavation of the 100-C-9:1 site was performed July 27 through July 29, 2006.

The results of both verification sampling events indicate that the waste removal actions achieved compliance with the remedial action objectives for the 100-C-9:1 subsite. A summary of the cleanup evaluations of the verification data against the applicable cleanup criteria is presented in Table ES-1. The results of the verification sampling are used to make a reclassification decision for the 100-C-9:1 subsite in accordance with the TPA-MP-14 (DOE-RL 2007) procedure.

In accordance with this evaluation, the verification sampling results support a reclassification of the 100-C-9:1 subsite to Interim Closed Out. The current site condition achieves the remedial action objectives and the corresponding remedial action goals established in the *Remedial Design Report/Remedial Action Work Plan for the 100 Area* (DOE-RL 2005b) and the *Interim Action*

Record of Decision for the 100-BC-1, 100-BC2, 100-DR-1, 100-DR-2, 100-FR-1, 100-FR-2, 100-HR-1, 100-HR-2, 100-KR-1, 100-KR-2, 100-IU-2, 100-IU-6, and 200-CW-3 Operable Units, Hanford Site, Benton County, Washington (Remaining Sites ROD)(EPA 1999). The results of verification sampling show that residual contaminant concentrations in the shallow zone do not preclude any future uses (as bounded by the rural-residential scenario) and allow for unrestricted use of shallow zone soils (i.e., surface to 4.6 m [15 ft] deep). The results also demonstrate that residual contaminant concentrations are protective of groundwater and the Columbia River. The suitability of direct exposure to deep zone soils has not been demonstrated. Therefore, institutional controls will be needed to prevent uncontrolled drilling/excavation of the deep-zone section of the 100-C-9:1 Main Process Sewer Collection Line that is left in place.

Soil cleanup levels were established in the Remaining Sites ROD (EPA 1999) based on a limited ecological risk assessment. Although not required by the Remaining Sites ROD, a comparison of ecological risk screening levels to the available analytical data has been made. Ecological screening levels were exceeded for antimony, boron, mercury, and vanadium. Exceedance of screening values does not necessarily indicate the existence of added risk to ecological receptors. Specifically, the values for antimony and vanadium are below the Hanford Site background levels, the concentrations measured for mercury are within the range of Hanford Site background levels, and the concentrations measured for boron are consistent with values seen elsewhere at the Hanford Site. Exceedances of ecological risk screening levels at the 100-C-9:1 subsite will be evaluated in the context of additional lines of evidence for ecological effects following a baseline risk assessment for the river corridor portion of the Hanford Site, which includes a more complete quantitative ecological risk assessment. That baseline risk assessment will be used to support the final closeout decision for the 100-C-9 waste site.

Table ES-1. Summary of Remedial Action Goals for the 100-C-9:1 Subsite

Regulatory Requirement	Remedial Action Goals (RAG)	RESULTS	RAG Attained
Direct Exposure – Radionuclides	1. Attain 15 mrem/yr dose rate above background over 1,000 years.	1. No radionuclide COCs or COPCs were identified for the 100-C-9:1 subsite.	N/A
Direct Exposure – Nonradionuclides	1. Attain individual RAGs.	1. Benzo(a)pyrene was quantified above the direct exposure RAG in overburden material but was determined to be the result of asphalt cross-contamination and was not considered further as a COC/COPC. All other individual COC/COPC concentrations are below the RAGs.	Yes
Meet Nonradionuclide Risk Requirements	1. Hazard quotient of <1 for noncarcinogens.	1. The hazard quotients for individual nonradionuclide COCs/COPCs are <1.	Yes
	2. Cumulative hazard quotient of <1 for noncarcinogens.	2. The cumulative hazard quotients are <1 for the excavated areas and stockpiled overburden.	
	3. Excess cancer risk of <1 x 10 ⁻⁶ for individual carcinogens.	3. Excess cancer risk values for individual nonradionuclide COCs/COPCs are <1 x 10 ⁻⁶ .	
	4. Attain a total excess cancer risk of <1 x 10 ⁻⁵ for carcinogens.	4. Total excess cancer risk values are <1 x 10 ⁻⁵ for the excavated areas and stockpiled overburden.	
Groundwater/River Protection – Radionuclides	1. Attain single COC groundwater & river RAGs.	1. No radionuclide COCs/COPCs were identified for the 100-C-9:1 subsite.	N/A
	2. Attain National Primary Drinking Water Regulations ^a 4-mrem/yr (beta/gamma) dose standard to target receptor/organ.	2. No radionuclide COCs/COPCs were identified for the 100-C-9:1 subsite.	
	3. Meet drinking water standards for alpha emitters: the more stringent of 15 pCi/L MCL or 1/25 th of the derived concentration guide for DOE Order 5400.5 ^b .	3. No alpha-emitting radionuclide COCs/COPCs were identified for the 100-C-9:1 subsite.	
	4. Meet total uranium standard of 21.2 pCi/L ^c .	4. Uranium was not identified as a COC/COPC for the 100-C-9:1 subsite.	
Groundwater/River Protection – Nonradionuclides	1. Attain individual nonradionuclide groundwater and river cleanup requirements.	1. Residual concentrations of beryllium, chromium, copper, and mercury exceeded soil RAGs for the protection of groundwater and/or the Columbia River and/or failed one or more parts of the WAC 173-340 test in comparison against those RAGs. However, results of vertical migration modeling predict that none of these constituents will migrate to groundwater (and thus the Columbia River) within 1,000 years ^d . Therefore, residual concentrations achieve the remedial action objectives for groundwater and river protection.	Yes

^a “National Primary Drinking Water Regulations” (40 *Code of Federal Regulations* 141).^b *Radiation Protection of the Public and the Environment* (DOE Order 5400.5).^c Based on the isotopic distribution of uranium in the 100 Areas, the 30 µg/L MCL corresponds to 21.2 pCi/L. Concentration-to-activity calculations are documented in *Calculation of Total Uranium Activity Corresponding to a Maximum Contaminant Level for Total Uranium of 30 Micrograms per Liter in Groundwater* (BHI 2001).^d *100 Area Analogous Sites RESRAD Calculations* (BHI 2005a).

COC = contaminant of concern

N/A = not applicable

COPC = contaminant of potential concern

RAG = remedial action goal

MCL = maximum contaminant level

REMAINING SITES VERIFICATION PACKAGE FOR THE 100-C-9:1 MAIN PROCESS SEWER PIPELINE

1.0 STATEMENT OF PROTECTIVENESS

This report demonstrates that the 100-C-9:1 waste subsite meets the objectives for interim closure as established in the *Remedial Design Report/Remedial Action Work Plan for the 100 Area* (RDR/RAWP) (DOE-RL 2005b) and the *Interim Action Record of Decision for the 100-BC-1, 100-BC-2, 100-DR-1, 100-DR-2, 100-FR-1, 100-FR-2, 100-HR-1, 100-HR-2, 100-KR-1, 100-KR-2, 100-IU-2, 100-IU-6, and 200-CW-3 Operable Units, Hanford Site, Benton County, Washington* (Remaining Sites ROD) (EPA 1999). The results of verification sampling show that residual contaminant concentrations in the shallow-zone soils (i.e., surface to 4.6 m [15 ft] deep) do not preclude any future uses (as bounded by the rural-residential scenario). The results also demonstrate that residual contaminant concentrations in both the shallow and deep zones are protective of groundwater and the Columbia River. Because the suitability of direct exposure to deep zone soils has not been demonstrated, institutional controls to prevent uncontrolled drilling/excavation are required for the section of the 100-C-9:1 pipeline that was not excavated in the deep zone (>4.6 m [15 ft] deep).

Soil cleanup levels were established in the Remaining Sites ROD (EPA 1999) based on a limited ecological risk assessment. Although not required by the Remaining Sites ROD, a comparison of ecological risk screening levels to the available analytical data has been made. Ecological screening levels for shallow zone soils were exceeded for antimony, boron, mercury, and vanadium. Exceedance of screening values does not necessarily indicate the existence of added risk to ecological receptors. Specifically, the values for antimony and vanadium are below the Hanford Site background levels, the concentrations measured for mercury are within the range of Hanford Site background levels, and the concentrations measured for boron are consistent with values seen elsewhere at the Hanford Site. Exceedance of ecological risk screening levels at the 100-C-9:1 waste site will be evaluated in the context of additional lines of evidence for ecological effects following a baseline risk assessment for the river corridor portion of the Hanford Site, which includes a more complete quantitative ecological risk assessment. That baseline risk assessment will be used to support the final closeout decision for the 100-C-9 waste site.

2.0 GENERAL SITE INFORMATION AND BACKGROUND

The 100-C-9 waste site includes the underground sanitary and process sewers and process pipelines associated with the 100-C Area pre-reactor water treatment facilities. The 100-C-9 waste site was administratively divided into four subsites based on the intended use of the pipes (e.g., sanitary or process sewer), expected sources of contamination, and potential differing remedial action requirements. The four 100-C-9 subsites are as follows:

1. 100-C-9:1 Main Process Sewer Collection Line
2. 100-C-9:2 Sanitary Sewers
3. 100-C-9:3 Clearwell Pipes
4. 100-C-9:4 Cooling Water Transfer Pipelines and Tunnels.

This remaining sites verification package addresses only the 100-C-9:1 Main Process Sewer Collection Line. A map of 100-C-9:1 is presented as Figure 1.

The 100-C-9:1 Main Process Sewer Collection Line waste subsite includes pipelines from the 183-C and 190-C facilities that fed into the main process sewer. The main process sewer itself consists of dual 1.2-m by 1.8-m (48-in. by 72-in.)-reinforced concrete box sewers that share a central dividing wall. The dual reinforced concrete box sewer is often referred to as the twin box culvert in meetings and documents pertaining to this site. The floor, top, and walls of the twin box culvert are approximately 0.3 m (1 ft) thick. The floor was poured first, and then the walls and ceiling were added in sections. Cold joints exist between different sections of the floor, along the interface between the floor and walls, as well as between each wall section. Cold joints are the most likely location for leaks to have occurred. Given the construction sequence, leaks from the cold joints could have developed at any point along the length of the structure between the floor and walls.

The 100-C-9:1 main process sewer begins down-gradient from the 183-C sedimentation basins and is oriented east-west, running to the north of the 100-C Area water treatment and pump house facilities (Figure 1). Multiple feeder pipes of various sizes from the 183-C and 190-C facilities discharged into the twin box culvert. The intended purpose of these pipelines was to handle diluted, nonhazardous process wastes and storm water. Sanitary wastes were handled separately via multiple septic systems. North of the 105-C Reactor Building, the twin box culvert changed orientation to approximately north-south and ran north to the former 132-C-2 outfall (remediated and interim closed in 2002 [BHI 2002]).

3.0 CONFIRMATORY SAMPLING ACTIVITIES AND EVALUATION

Confirmatory sampling of the 100-C-9:1 twin box culvert was performed during September and October of 2003 (BHI 2003a) to collect information to support evaluation of the site against the remedial action goals (RAGs) and remedial action objectives established by the Remaining Sites ROD (EPA 1999). Based on the results of the confirmatory sampling, it was determined that remedial action at the site was necessary (Feist 2004) wherever the sewer existed in the shallow zone (i.e., surface to 4.6 m [15 ft] deep). The following subsections provide additional discussion of confirmatory sampling activities and results.

3.1 CONFIRMATORY SAMPLING DESIGN

Historical drawings, process knowledge, and site visit information were used to develop a site-specific confirmatory sampling design with focused sampling of pipeline contents and underlying soil at the 100-C-9:1 subsite (BHI 2003a). Confirmatory sampling was performed from September 30 through October 13, 2003, as described in the sampler's field logbook (BHI 2003b). It was noted during sampling that scale on the inside wall of the twin box culvert was limited to the bottom 0.6 m (2 ft) of that wall.

Figure 1. 100-C-9:1 Main Process Sewer Collection Line.

The top of the scale has been referred to as the “bathtub ring” in meetings and documents associated with 100-C-9:1. A scale sample from the inside of the box culvert and a soil sample from directly below the culvert were collected at two focused sampling locations (Figure 2):

1. Shallow Zone Sample Location (B1/B2) - An exposed section at the north end of the box culvert located at a depth of 2.6 m (8.5 ft) at Washington State Plane Coordinates N 145262.97, E 565724.84.
2. Deep Zone Sample Location (B3/B4) - A test pit, located at a manhole, excavated to a depth of 8.2 m (27 ft) at the southern end of the box culvert at Washington State Plane Coordinates N 145250.72, E 565435.09.

A summary of the confirmatory samples collected and laboratory analyses performed is provided in Table 1.

3.2 CONFIRMATORY SAMPLING RESULTS

All samples were analyzed at offsite commercial laboratories and the results compared against the cleanup criteria specified in the RDR/RAWP (DOE-RL 2005b). The laboratory results for the confirmatory samples are provided in Appendix A (Table A-1).

The samples were analyzed for contaminants of potential concern (COPCs) that included hexavalent chromium, inductively coupled plasma (ICP) metals, mercury, polychlorinated biphenyls (PCBs), semivolatile organic compounds, sulfate, pH, and radionuclides. Field screening using an organic vapor monitor was also performed; no volatile organic compounds (VOCs) were detected.

For decision-making purposes, the 100-C-9:1 main process sewer was divided into a northern and a southern decision unit, at a point approximately 80 m (263 ft) north of B Avenue where the contaminated portion of the twin box culvert transitions from the shallow zone (less than 4.6 m [15 ft] below ground surface) to the deep zone (more than 4.6 m [15 ft] below ground surface). The northern section of the twin box culvert is all within the shallow zone. The southern section is partially in the deep zone and partially in the shallow zone. A map showing the deep zone section of the twin box culvert is presented in Figure 3.

The scale and soil sample results at each location were evaluated according to the cleanup criteria specified in the RDR/RAWP (DOE-RL 2005b). The results indicated that elevated levels of hexavalent chromium and mercury in scale and elevated hexavalent chromium in underlying soil required removal wherever the contaminated portion (below the “bathtub ring”) of the twin box culvert was present in the shallow zone. Furthermore, the results supported leaving the twin box culvert in place wherever the top of the scale (indicated by the “bathtub ring”) is at a depth greater than 4.6 m (15 ft) below ground surface, since the criteria for protection of groundwater and the Columbia River are met. RESRAD (RESidual RADioactivity) modeling (BHI 2004e) was performed using the confirmatory sample results to evaluate compliance with RAGs and determine COPCs for remediation.

Figure 2. Confirmatory Sampling Locations on the 100-C-9:1 Main Process Sewer.

Table 1. 100-C-9:1 Confirmatory Sample Summary Table.

Sample Location	Location Description	Sampling Access	Sample Location	WSP Coordinates	Sample Media	HEIS Sample Number	Sample Analyses
B1	Concrete Structure at north end of process sewer	Site exposed from previous pipeline remediation	East & west walls of the concrete structure 2.6 m (8.5 ft) bgs	N 145262.97 E 565724.84	Scabbled concrete scale with greenish-yellow scale.	J00YP2	ICP metals, mercury, PCBs, sulfate, pH, SVOA, GEA, gross alpha, gross beta.
						J00YP4	Hexavalent chromium
B2	Under Concrete Structure at north end of process sewer	Breached section	Below breached section 2.6 m (8.5 ft) bgs	N 145262.97 E 565724.84	Soil consisting of 70% sand and 30% pebbles and coarse sand with very little silt.	J00YP7	ICP metals, mercury, hexavalent chromium, PCBs, sulfate, pH, SVOA, GEA, gross alpha, gross beta.
B3	North of 105-C Reactor	Manhole north of 105-C Reactor	12 ft south of manhole along east and west walls 8.2 m (27 ft) bgs	N 144250.72 E 565435.09	Scabbled concrete scale along east and west wall.	J00YP3	ICP metals, mercury, PCBs, sulfate, pH, SVOAs, GEA, gross alpha, gross beta.
						J00YP5	Hexavalent chromium
B4	Under pipeline north of 105-C Reactor	Trench along side of twin box sewers	Underneath twin box sewer 8.2 m (27 ft) bgs	N 144250.72 E 565435.09	Soil under pipe, medium to dark brown silt and sand with cobbles. Pipe wrap debris in the soil.	J00YP8	ICP metals, mercury, hexavalent chromium, PCBs, sulfate, pH, SVOA, GEA, gross alpha, gross beta.
Equipment Blank	N/A	N/A	N/A	N/A	Silica sand.	J00YP9	ICP metals, mercury, hexavalent chromium, PCBs, sulfate, SVOA.
Duplicate	Duplicate of B2 (J00YP7)	Breached section	Below breached section 2.6 m (8.5 ft) bgs	N 145262.97 E 565724.84	Soil consisting of 70% sand and 30% pebbles and coarse sand with very little silt.	J00YR0	ICP metals, mercury, hexavalent chromium, PCBs, sulfate, pH, SVOA, GEA, gross alpha, gross beta.

Source: Logbook EL-1578-1, pages 18-21, 41, 44-45 and 54-55 (BHI 2003b).

bgs = below ground surface

GEA = gamma energy analysis

HEIS = Hanford Environmental Information System

ICP = inductively coupled plasma

N/A = not applicable

PCB = polychlorinated biphenyl

SVOA = semivolatile organic analysis

WSP = Washington State Plane

Figure 3. 100-C-9:1 Deep Zone.

4.0 DEVELOPMENT OF AN EXCAVATION AND CLOSEOUT STRATEGY

Representatives of the Remedial Action Project and the Environmental Protection Agency (EPA) met on November 1, 2004, to discuss the approach for excavation and closeout of the 100-C-9:1 site. The results of the confirmatory sampling and a conceptual model for the twin box culvert (Figure 4) were used to develop the following points of agreement:

- Overburden is assumed clean.
- Contaminated surface scale inside the culvert is assumed to not penetrate more than 2.5 cm (1 in.).
- Visual observations indicate a high water mark or “bathtub ring” inside the culvert that is no higher than 0.6 m (2 ft).
- The culvert is a gravity flow system (i.e., not under pressure).
- Potential leaks to underlying soil are most likely via “cold joints” in the culvert floor.
- Potential leaks at “cold joints” on the sides of the culvert are vertical (no lateral flow).
- There is a relatively small volume of potentially contaminated soil.

Figure 4. 100-C-9:1 Excavation Cross-Section.

Using the confirmatory sample data (Appendix A) and the conceptual model (Figure 4), a path forward was developed for the excavation and closeout strategy for the 100-C-9:1 site, as summarized in Figure 5.

Figure 5. From 100 BC Box Culvert Sampling CCN 117558 (BHI 2004b).

- Overburden (i.e., soil above the top of the culvert) will be field screened for radiological activity and stockpiled for use as clean backfill.
- Soil that is excavated from the top of the culvert down to 0.6 m (2 ft) above the bottom of the culvert will be field screened for radiological activity and stockpiled for use as clean backfill.
- Once focused sampling of selected cold joints has established that no hexavalent chromium or mercury are present at levels exceeding cleanup criteria, then random in-process samples will be taken as needed.
- The random in-process samples can be used to support closeout sample decisions.
- Once radiological field screening and in-process samples indicate excavated soil is below the cleanup criteria, it can be stockpiled and used for clean backfill.
- All concrete from the culvert in the shallow zone will go to the Environmental Restoration Disposal Facility (ERDF).
- Soil adjacent to the culvert at a level below the high water mark (the bathtub ring) will be excavated and disposed to ERDF.
- The concrete culvert in the deep zone will not be removed based on scale and soil data collected during previous confirmatory sampling, because the analytical results indicate the culvert meets deep zone cleanup criteria.
- The bottom of the excavation will be field screened on a grid using radiological surveys.
- Statistical verification/closeout sampling will be limited to the bottom of the excavation (i.e., no verification sampling of sidewalls, stockpiles, or overburden is necessary).
- Statistical verification/closeout samples will be analyzed for ICP metals, mercury, and hexavalent chromium.
- Statistical verification/closeout samples will be analyzed for radionuclides only if radiological activity is detected during the gridded radiological surveys of the bottom of the excavation.

On June 8, 2006, representatives of the Field Remediation Project and EPA met to discuss the approach for closeout of the southern portion of the 100-C-9:1 site. It was decided that gridded radiological surveys of the excavation and the soil stockpiles for the southern portion were not necessary because: (1) no radiological activity had been found during excavation and closeout surveys performed for the northern section of the twin box culvert, and (2) no radiological contamination was detected during excavation of the southern portion of the box culvert or in samples collected from the cold joints. Gridded radiological surveys were initially performed for the soil stockpiles during 2005 and then ceased for soil stockpiles during 2006. These surveys are provided in Appendix B.

This excavation and closeout strategy was adopted and followed, as described in the following remedial action summary.

5.0 REMEDIAL ACTION SUMMARY

Remediation of the 100-C-9:1 Main Process Sewer Collection Line proceeded in two phases. The first phase addressed the northern portion and the second phase addressed the southern portion of the 100-C-9:1 waste site.

5.1 NORTHERN 100-C-9:1

Remedial action of the northern section of 100-C-9:1 was initiated on November 22, 2004, and continued into February 2005. Approximately 14,639 metric tons (16,137 U.S. tons) of contaminated soil and concrete were removed for disposal to the Environmental Restoration Disposal Facility (ERDF). Excavated soils around the twin box culvert were segregated using the diagram presented in Figure 4 as a guide. The north section of the 100-C-9:1 twin box culvert was excavated from the remediation boundary of the former 132-C-2 outfall south to the beginning of the southern portion of the 100-C-9:1 waste site. The transition between the northern and southern portions of 100-C-9:1 occurs at a point just north of B Avenue where the twin box culvert transitions from the shallow zone (less than 4.6 m [15 ft] below ground surface) to the deep zone (more than 4.6 m [15 ft] below ground surface). Concrete from the twin box culvert and a minimum of 0.3 m (1 ft) of underlying soil was removed and disposed of at ERDF. Figures 6 and 7 provide the pre-excavation and post-excavation topographic surveys, respectively, for the northern section of the 100-C-9:1 site.

5.1.1 Northern 100-C-9:1 Cold Joint Soil Sampling

During the excavation of the twin box culvert, stakes were used to mark the location of the lateral cold joints. The cold joints were identified as possible leak points for the twin box culvert. Five separate cold joint locations were targeted for post-excavation sampling. The sample locations are shown in Figure 8. The cold joint samples were analyzed for ICP metals, mercury, hexavalent chromium, and metals by the Toxicity Characteristic Leaching Procedure (TCLP). The samples were analyzed at offsite commercial laboratories, and the sample results

Figure 6. Pre-excavation Topographic Survey of the Northern 100-C-9:1 Waste Site.

Figure 7. Post-Excavation Topographic Survey of the Northern 100-C-9:1 Waste Site.

Figure 8. Cold Joint Sampling Locations for the Northern 100-C-9:1 Site.

are presented in Appendix A (Table A-2). Site cleanup criteria are specified in the RDR/RAWP (DOE-RL 2005b). The cold joint sample results indicated that the excavation of the northern section of the 100-C-9:1 site was sufficient and that the site was ready for verification sampling to be performed.

5.1.2 Northern 100-C-9:1 Overburden Stockpiles

The overburden was removed and stockpiled on the west side of the excavation (Figure 9). Field radiological surveys of overburden stockpiles, performed in May 2005, indicated no detectable radiological contamination above background. The radiological survey results are provided in Appendix B and support the decision to use the overburden as clean backfill, as agreed to with the EPA (BHI 2004b).

5.1.3 Northern 100-C-9:1 Soil Stockpiles (Assumed BCL)

Soils above the high-water mark (i.e., soils above the bathtub ring, or soils above 0.6 m [2 ft] above the floor) and not directly in contact with the concrete were removed, stockpiled, and managed as assumed below-cleanup-level (BCL) soil. Gridded radiological survey results indicated no detectable radiological contamination above background (Appendix B). Therefore the assumed BCL stockpiles were used as clean backfill for the excavation, as agreed to with the EPA (BHI 2004b).

5.1.4 Northern 100-C-9:1 Soil Stockpiles (Suspect BCL)

Soils adjacent to the culvert that were excavated from above the high water mark were stockpiled on site in three piles and managed as suspect BCL material (Figure 9). Radiological surveys of these stockpiles were performed to support evaluation of the suitability of the soil for use as backfill material, as agreed to with EPA (BHI 2004b). Gridded radiological survey results indicated no detectable radiological contamination above background (Appendix B). In addition to the radiological survey results, each of the three suspect BCL stockpiles were sampled and analyzed for contaminants of concern (COCs). Samples collected from the BCL stockpiles supported the use of the soil as backfill material for the excavation. Data for the northern suspect BCL stockpiles is included in the northern 95% upper confidence limit (UCL) calculation (Appendix C).

5.1.5 Northern 100-C-9:1 Excavated Soil/Concrete (Below high-water mark)

The concrete structure of the twin box culvert and soils adjacent to the twin box culvert from below the level of the high water mark (bathtub ring) were excavated and disposed of at ERDF.

5.1.6 Northern 100-C-9:1 Base of Excavation

Gridded radiological surveys of the soils at the bottom of the excavation were performed (Appendix B). Of the 45,396 data points measured using gridded radiological surveys, five data points were slightly above background. These values are statistically insignificant compared to the overall size of the data set.

Figure 9. Soil Stockpiles Along the East and West Edges of the Northern 100-C-9:1 Excavation.

5.1.7 Northern 100-C-9:1 Shallow/Deep Zone Transition

The northern portion of the 100-C-9:1 site was entirely in the shallow zone (less than 4.6 m [15 ft] below ground surface). The northern 100-C-9:1 excavation exposed the northern end of the deep zone (more than 4.6 m [15 ft] below ground surface) section of the twin box culvert. Samples of scale from within the exposed deep zone structure and soil from below that structure (J030C5, J030C6, J030C7, J030C8, J030C9, and J030D0) were collected in March 2005 (BHI 2004c). Sample data from this shallow/deep zone transition are presented in Appendix A (Table A-3). An evaluation of the sample results verified the suitability of leaving the box culvert in place in the deep zone (WCH 2006f).

5.2 SOUTHERN 100-C-9:1

Remedial action of the southern portion of the 100-C-9:1 site was initiated in December 2004 and completed on April 19, 2006. Figures 10 and 11 provide the pre-excavation and post-excavation topographic surveys of the southern section of the 100-C-9:1 subsite. Overburden material and other presumed BCL soils were stockpiled south of the excavation and west of the 105-C Reactor for post-remediation verification sampling. Figure 12 provides a map of the soil stockpiles. Approximately 5,851 metric tons (6,450 U.S. tons) of contaminated soil and concrete were removed by direct load out for disposal to ERDF. The southern portion of the 100-C-9:1 box culvert was excavated to a point approximately 200 m (656 ft) northwest of the 105-C Reactor, where the southern portion of the twin box culvert transitioned from the shallow zone to the deep zone. Concrete from the shallow zone twin box culvert and a minimum of 0.3 m (1 ft) of underlying soil were disposed of at ERDF.

As mentioned earlier, at a meeting on June 8, 2006, representatives of the Washington Closure Hanford (WCH) Field Remediation Project and EPA agreed that gridded radiological surveys of the southern 100-C-9:1 excavation and soil stockpiles were not necessary because: (1) no radiological activity had been found during excavation and closeout surveys performed for the northern section of the twin box culvert and (2) no radiological contamination was detected during excavation of the southern portion of the box culvert or in samples collected from the cold joints. Gridded radiological surveys performed before June 8, 2006 are provided in Appendix B. The radiological surveys did not identify radiological contamination above background.

Figure 10. Southern 100-C-9:1 Pre-Excavation Topographic Survey Map.

Figure 11. Southern 100-C-9:1 Post-Excavation Topographic Survey Map.

G:\100BC\100-C-9 SOUTH SOIL STOCK PILE

100-C-9:1 SOIL STOCKPILES

5.2.1 Southern 100-C-9:1 Cold Joints

During excavation of the box culvert, four cold joints were located as shown in Figure 13. In-process soil samples were collected adjacent to the 1st and 2nd cold joints. Samples of soil directly below the twin box culvert and scale from within the twin box culvert, at the original east end cold joint, were collected. Data from the cold joint sampling are presented in Appendix A (Table A-4). All of these cold joints were removed because concentrations of mercury and hexavalent chromium were present in the scale in the shallow zone, exceeding direct exposure cleanup levels. Subsequently, an additional 30 m (98 ft) of the box culvert, east of the 1st cold joint, was removed to ensure that the entire twin box culvert with scale present in the shallow zone was removed. At the east end of this additional excavation, samples of scale inside the twin box culvert and soil directly below the twin box culvert were collected to support leaving the remaining portion of the twin box culvert in the deep zone in place (see Section 5.2.3).

5.2.2 Southern 100-C-9:1 Soil Stockpiles

Overburden and BCL soil (i.e., soils above the bathtub ring or high water mark and not in direct contact with the twin box culvert or feeder pipelines) were stockpiled south of the southern excavation in ten stockpiles (Figure 12). The stockpiles were sampled and evaluated. Where multiple lifts were used to stockpile the excavated soils, each lift was sampled and evaluated. An evaluation of the verification samples found the soil stockpiles to be suitable for use as clean backfill. Laboratory data for samples of the overburden and BCL stockpiles are provided in Appendix A (Table A-5).

5.2.3 Southern 100-C-9:1 Deep Zone Transition

Note: In the discussion of the northern section of 100-C-9:1, an evaluation at the shallow/deep zone transition was presented. That evaluation pertained to samples collected at the north end of the deep zone. The evaluation discussed here pertains to samples collected at the south end of the deep zone.

To confirm previous findings with regard to the deep-zone twin box culvert, samples of scale and underlying soil from the exposed deep-zone structure (at the east end of the southern excavation) were collected in April 2006 (BHI 2004c). The scale and soil sample data re-affirmed the confirmatory sample evaluation that the contamination (mercury and hexavalent chromium) within and below the twin box culvert could be left in place in the deep zone (WCH 2006f, WCH 2007a). An additional 30 m (98 ft) of the twin box culvert, east of the 1st cold joint, was removed to ensure that any contamination present in the shallow zone was removed, see Figure 11. At the east end of the excavation, samples of scale and underlying soil were also collected from the exposed deep-zone twin box culvert, and evaluated (J11XK4, J11XK5, J11XK6, J11XK7, J11XX2, J11XX5, J11XN8, and J11XN9). These samples also supported leaving the twin box culvert in place in the deep zone. All of these samples were analyzed at offsite commercial laboratories and the data are presented in Appendix A (Table A-5). Evaluations of the analytical data were performed by comparing the analyses to the cleanup criteria specified in the RDR/RAWP (DOE-RL 2005b).

Figure 13. Southern 100-C-9:1 Cold Joint Soil Sample Locations.

5.3 Southern 100-C-9:1 Waste Characterization

Several areas of discolored soil were sampled in support of waste characterization and to guide the excavation. The laboratory results for the waste characterization samples are provided in Appendix A (Table A-7).

6.0 VERIFICATION SAMPLING ACTIVITIES

Statistical sampling was performed for each of the northern and southern 100-C-9:1 remediation footprints. Statistical sampling was selected because the spatial distribution of potential residual soil contamination over the study area was uncertain. The decision rule for demonstrating compliance with the cleanup criteria requires comparison of the true population mean of COCs/COPCs (as estimated by the 95% upper confidence limit on the sample mean) with the cleanup level. The Washington State Department of Ecology publication *Guidance on Sampling and Data Analysis Methods* (Ecology 1995) recommends that systematic sampling with sample locations distributed over the entire study area be used. Therefore, sampling locations were distributed over the remediation footprint on an area-by-area basis using random-start systematic grids in an effort to determine the potential residual presence of contamination.

Visual Sample Plan¹ (VSP) was used to develop the statistical sampling designs for the 100-C-9:1 waste site. The remediation footprints (Figures 7 and 11) were delineated in VSP and used as the basis for locating systematic grids for verification soil sample collection.

Sampling was performed in accordance with ENV-1, "Environmental Monitoring and Management," to fulfill the requirements of the *100 Area Remedial Action Sampling and Analysis Plan* (SAP) (DOE-RL 2005a). All samples were submitted for full protocol laboratory analysis.

Separate verification work instructions were prepared for the northern and southern sections of 100-C-9:1 (BHI 2005b and WCH 2006c, respectively).

6.1 Contaminants of Concern

The results of confirmatory sampling, cold joint soil sampling, and agreements with the EPA were used to develop the COCs for verification sampling. Confirmatory sampling found concentrations of antimony, cadmium, total chromium, hexavalent chromium, copper, lead, manganese, and mercury to be above the cleanup criteria. These analytes were carried forward as COCs for verification sampling. Gridded radiological surveys of the excavations and stockpiles did not indicate the presence of radiological contamination above background; therefore radionuclides were not included as COCs for verification sampling (BHI 2004b). Verification samples were analyzed by the methods listed in Table 2.

¹ Visual Sampling Plan is a site map-based user-interface program that may be downloaded at <http://etd.pnl.gov:2080/DQO/software/vsp/>.

Table 2. Laboratory Analytical Methods.

ICP Metals ^a – EPA Method 6010
Mercury – EPA Method 7196
Hexavalent chromium – EPA Method 7196

^a The expanded list of ICP metals was performed to include antimony, arsenic, barium, beryllium, boron, cadmium, chromium (total), cobalt, copper, lead, manganese, molybdenum, nickel, silver (by trace analysis), selenium (by trace analysis), vanadium, and zinc in the analytical results package.

EPA = U.S. Environmental Protection Agency

ICP = inductively coupled plasma

6.2 100-C-9:1 Sample Designs

The verification sample designs were developed to support a determination that the residual soils at the 100-C-9:1 Main Process Sewer Collection Line meet the cleanup criteria specified in the RDR/RAWP (DOE-RL 2005b) and the Remaining Sites ROD (EPA 1999). Verification samples were collected from the base of the excavations where the twin box culvert or feeder pipelines were removed and from the suspect BCL soil stockpiles, as described in the following sections and in the individual verification sampling work instructions for the northern and southern portions of 100-C-9:1 (BHI 2005b, WCH 2006c). Verification sampling was performed August 23, 2005 at the northern portion of 100-C-9:1 and on July 27 through July 29, 2006 at the southern portion of 100-C-9:1.

6.2.1 100-C-9:1 Sample Design Location Basis

The post-excavation civil survey drawings (Figures 7 and 11) and global positioning surveys of the stockpiles (Figures 8 and 12) were used to develop the verification sampling plans for the northern and southern portions of the 100-C-9:1 waste site (BHI 2005b, WCH 2006c).

6.2.2 100-C-9:1 Verification Sample Design - BCL and Overburden Stockpiles

Sampling was performed at each of the stockpiles and on each of the lifts of soil placed into those stockpiles. Each sample consisted of 25 aliquots collected over the surface of the entire stockpile, or lift. The samples were analyzed for the expanded ICP metals list (antimony, arsenic, barium, beryllium, boron, cadmium, chromium, cobalt, copper, lead, manganese, molybdenum, nickel, selenium, vanadium, silver, and zinc), mercury, and hexavalent chromium.

6.2.3 100-C-9:1 Verification Sample Design - Base of Excavation

A statistical sampling design, generated using VSP, was deemed appropriate for these excavations. A total of 22 primary soil samples (Figure 14, Table 3) were collected from the base of the northern 100-C-9:1 excavation, as specified by the northern sampling plan (BHI 2005b). A total of 23 primary soil samples (Figure 15, Table 4) were collected from the southern 100-C-9:1 excavation, as specified by the southern sampling plan (WCH 2006c). Duplicate soil samples and equipment blanks were also collected for each of the sampling events.

Figure 14. Post Excavation Verification Sampling Locations for the Northern Section of 100-C-9:1.

**Table 3. 100-C-9:1 Northern Statistical
Verification Sample Location Coordinates.**

E Coordinate	N Coordinate	Statistical Sample	Sample Number	Sample Duplicate
565723.9	145255.1	1	J03WX7	J03X12
565728.6	145284.6	2	J03WX8	--
565722.3	145300.7	3	J03WX9	--
565716.1	145316.8	4	J03WY0	--
565709.9	145332.9	5	J03WY1	--
565727.0	145330.3	6	J03WY2	--
565720.7	145346.3	7	J03WY3	--
565725.4	145375.9	8	J03WY4	--
565723.7	145421.5	9	J03WY5	--
565728.4	145451.0	10	J03WY6	--
565660.9	145029.0	11	J03WY7	--
565665.5	145058.5	12	J03WY8	--
565681.0	145101.5	13	J03WY9	--
565685.6	145131.0	14	J03X00	--
565701.0	145174.0	15	J03X01	--
565705.7	145203.5	16	J03X02	--
565597.1	144808.0	17	J03X03	--
565601.7	144837.6	18	J03X04	--
565617.2	144880.5	19	J03X05	--
565621.8	144910.1	20	J03X06	--
565637.2	144953.0	21	J03X07	--
565641.9	144982.6	22	J03X08	--

6.3 Verification Sampling Results

Verification samples were analyzed using EPA-approved analytical methods. The 95% UCL on the true population mean for residual concentrations of COCs and COPCs were calculated for the remediation footprints as specified by the RDR/RAWP (DOE-RL 2005b), with separate calculations for the northern and southern sections of 100-C-9:1 provided in Appendix C. When a nonradionuclide COC or COPC was detected in fewer than 50% of the verification samples collected for each area, the maximum detected value was used for comparison to RAGs. If no detections for a given COC/COPC were reported in a given data set, then no statistical evaluation or calculations were performed for that COC/COPC for the associated sampling area. The evaluation of the verification data from the stockpiles was performed by direct comparison of the maximum sample results for each COC/COPC against cleanup criteria for each sampling area.

Figure 15. Verification Sampling Locations for the Southern Section of 100-C-9:1.

**Table 4. 100-C-9:1 Southern Statistical
Verification Sample Location Coordinates.**

E Coordinate	N Coordinate	Statistical Sample	Sample Number	Sample Duplicate
564985.6	144064.5	1	J12XV3	--
564805.7	144093.3	2	J12XV4	J12XY3
564895.4	144094.4	3	J12XV5	--
564985.2	144095.6	4	J12XV6	--
564814.4	144108.9	5	J12XV7	J12XY4
564904.2	144110.1	6	J12XV8	--
564805.3	144124.4	7	J12XV9	--
564823.3	144124.6	8	J12XW0	--
564841.2	144124.8	9	J12XW1	--
564859.1	144125.1	10	J12XW2	--
564877.1	144125.3	11	J12XW3	--
564895.0	144125.5	12	J12XW4	--
564913.0	144125.7	13	J12XW5	--
564931.0	144126.0	14	J12XW6	--
564948.9	144126.2	15	J12XW7	--
564966.8	144126.4	16	J12XW8	--
564984.8	144126.7	17	J12XW9	--
565002.7	144126.9	18	J12XX0	--
565020.7	144127.1	19	J12XX1	--
565038.6	144127.4	20	J12XX2	--
565056.6	144127.6	21	J12XX3	--
565074.5	144127.8	22	J12XX4	--
565092.5	144128.0	23	J12XX5	--

Comparisons of the statistical and maximum results for COCs and COPCs to the site RAGs for the remediation footprints, as well as the stockpiles, are summarized in Tables 5, 6, 8, and 9. Contaminants that were not detected by laboratory analysis or that were not identified as COCs or COPCs are excluded from these tables. Cleanup levels for aluminum, calcium, iron, magnesium, potassium, silicon, sodium, and zirconium are not presented in the RDR/RAWP (DOE-RL 2005b). Similarly, parameters to calculate cleanup levels for these constituents are not presented in the *Cleanup Levels and Risk Calculations (CLARC) Database* (Ecology 2005) under WAC 173-340-740(3) or other reference databases. These analytes are essential nutrients and are eliminated from evaluation as human health concerns per EPA guidance (EPA 1989). Therefore, these constituents are not considered COPCs and are not included in the comparison tables. The laboratory-reported data results are stored in the Environmental Restoration (ENRE) project-specific database prior to being submitted to Hanford Environmental Information System (HEIS). Data for the 100-C-9:1 waste site are presented in Appendices A and C. Appendix A presents the confirmatory and in-process sample data. Appendix C presents the verification data and the 95% UCL calculations performed on the northern and southern verification data.

6.3.1 Northern 100-C-9:1 Verification Data Evaluation

Residual concentrations of the COCs and COPCs in the northern 100-C-9:1 excavation and stockpiles were all below the applicable RAGs. These results are summarized in Tables 5 and 6.

Table 5. Comparison of the Northern 100-C-9:1 Excavation Footprint Statistical Soil Samples and Maximum Stockpile Soil Samples Values to Action Levels. (2 Pages)

COC/COPC	Statistical or Maximum Result (mg/kg) ^a	Remedial Action Goals (mg/kg)			Does the Result Exceed RAGs?
		Direct Exposure	Soil Concentration for Groundwater Protection	Soil Concentration for River Protection	
Antimony ^b	0.47 (<BG)	32 ^c	5 ^d	5 ^d	No
Arsenic	2.7 (<BG)	20 ^e	20 ^e	20 ^e	No
Barium	68 (<BG)	5,600 ^k	132 ^{d,i}	224 ^m	No
Beryllium	0.33 (<BG)	10.4 ^g	1.51 ^d	1.51 ^d	No
Boron ^h	0.8	7,200 ^c	320	-- ⁱ	No
Cadmium ^b	0.14 (<BG)	13.9 ^g	0.81 ^d	0.81 ^d	No
Chromium (total)	8.9 (<BG)	80,000 ^k	18.5 ^d	18.5 ^d	No
Hexavalent chromium	0.37	2.1 ^g	4.8 ⁿ	2	No
Cobalt	8.1 (<BG)	1,600 ^c	32	-- ⁱ	No
Copper	16.8 (<BG)	2,960 ^c	59.2	22 ^d	No
Lead	4.0 (<BG)	353 ^j	10.2 ^d	10.2 ^d	No
Manganese	318 (<BG)	11,200 ^c	512 ^d	-- ⁱ	No
Mercury	0.05 (<BG)	24 ^c	0.33 ^d	0.33 ^d	No
Molybdenum ^h	0.42	400 ^c	8	-- ⁱ	No
Nickel	10.9 (<BG)	1,600 ^c	19.1 ^d	27.4	No
Selenium ^b	0.47 (<BG)	400 ^c	5	1	No
Vanadium	46.7 (<BG)	560 ^c	85.1 ^d	-- ⁱ	No

Table 5. Comparison of the Northern 100-C-9:1 Excavation Footprint Statistical Soil Samples and Maximum Stockpile Soil Samples Values to Action Levels. (2 Pages)

COC/COPC	Statistical or Maximum Result (mg/kg) ^a	Remedial Action Goals (mg/kg)			Does the Result Exceed RAGs?
		Direct Exposure	Soil Concentration for Groundwater Protection	Soil Concentration for River Protection	
Zinc	41.1 (<BG)	24,000 ^c	480	67.8 ^d	No

^a As determined by the 100-C-9:1 (North) Cleanup Verification 95% UCL Calculations(WCH 2006e).

^b Hanford Site-specific background is not available; not evaluated during background study. Value used is from *Natural Background Soil Metals Concentrations in Washington State* (Ecology 1994).

^c Noncarcinogenic cleanup level calculated from WAC 173-340-740(3), Method B, 1996.

^d Where cleanup levels are less than background, cleanup levels default to background (WAC 173-340-700[4][d]) (1996).

^e The cleanup value of 20 mg/kg has been agreed to by Tri-Party project managers. The basis for 20 mg/kg is provided in Section 2.1.2.1 of the RDR/RAWP (DOE-RL 2005b).

^f Calculated based on 100 x MCL x 2 (groundwater to river DAF).

^g Carcinogenic cleanup level calculated based on the inhalation exposure pathway (WAC 173-340-750[3], 1996).

^h No Hanford Site-specific or Washington State background value available.

ⁱ No cleanup level is available from the Cleanup Levels and Risk Calculations database, and no toxicity values are available to calculate cleanup levels (Ecology 2005).

^j A WAC 173-340-740(3) (1996) value for lead is not available. This value is based on the *Guidance Manual for the Integrated Exposure Update Biokinetic Model for Lead in Children* (EPA 1994).

^k Noncarcinogenic cleanup level calculated from WAC 173-340-740(3), 1996 (Method B for soils) (as presented in the RDR/RAWP [DOE-RL 2005b]). Updated oral reference dose values (as provided in IRIS) yield Method B direct exposure RAG values of 16,000 mg/kg and 120,000 mg/kg for barium and chromium, respectively.

^l Barium soil cleanup level for groundwater protection calculated from WAC 173-340-740(3)(a)(ii)(A), 1996 ("100 times rule") and WAC 173-340-720(3), 1996 (Method B for groundwater) is 112 mg/kg (as presented in the RDR/RAWP [DOE-RL 2005b]). The updated oral reference dose value (as provided in IRIS) yields a Method B groundwater cleanup criteria of 7 mg/L, as compared to the more restrictive maximum contaminant level of 2 mg/L (40 CFR 141). Per WAC 173-340-740(3)(a)(ii)(A), 1996 ("100 times rule"), the most restrictive updated soil cleanup level for groundwater protection would be 200 mg/kg.

^m Barium soil cleanup level for river protection calculated from WAC 173-340-740(3)(a)(ii)(A), 1996 ("100 times rule"), a dilution-attenuation factor of 2, and WAC 173-340-720(3), 1996 (Method B for groundwater) is 224 mg/kg (as presented in the RDR/RAWP [DOE-RL 2005b]). No surface water bioconcentration factor is available for barium and no ambient water quality criteria value exists separate from the previous drinking water standard; therefore no WAC 173-340-730(3), 1996 (Method B for surface waters) value can be determined.

ⁿ Calculated cleanup level (per WAC 173-340-720(3), 1996 [Method B for groundwater] and WAC 173-340-740(3)(a)(ii)(A), 1996 ["100 times rule"]) presented is lower than that presented in the RDR/RAWP (DOE-RL 2005b), based on updated oral reference dose value (as provided in IRIS).

-- = not applicable

BG = background

COC = contaminant of concern

COPC = contaminant of potential concern

CFR = Code of Federal Regulations

DAF = dilution attenuation factor

IRIS = Integrated Risk Information System

MCL = maximum contaminant level

RAG = remedial action goal

RDR/RAWP = remedial design report/remedial action work plan

UCL = upper confidence limit

WAC = Washington Administrative Code

Table 6. Comparison of the Northern 100-C-9:1 Overburden Maximum Soil Values to Action Levels (2 pages).

COC/COPC	Maximum Result (mg/kg)	Remedial Action Goals (mg/kg)			Does the Result Exceed RAGs?
		Direct Exposure	Soil Concentration for Groundwater Protection	Soil Concentration for River Protection	
Arsenic	4.9 (<BG)	20 ^a	20 ^a	20 ^a	No
Barium	79.7 (<BG)	5,600 ^k	132 ^{c, l}	224 ^m	No
Beryllium	0.36 (<BG)	10.4 ^e	1.51 ^c	1.51 ^c	No
Boron ^f	2.4	7,200 ^b	320	-- ^g	No
Cadmium ^h	0.09 (<BG)	13.9 ^e	0.81 ^c	0.81 ^c	No
Chromium (total)	9.8 (<BG)	80,000 ^k	18.5 ^c	18.5 ^c	No
Hexavalent chromium	0.30	2.1 ^e	4.8 ⁿ	2	No
Cobalt	7.6 (<BG)	1,600 ^b	32	-- ^g	No
Copper	17.0 (<BG)	2,960 ^b	59.2	22 ^c	No
Lead	6.3 (<BG)	353 ⁱ	10.2 ^c	10.2 ^c	No
Manganese	329 (<BG)	11,200 ^b	512 ^c	-- ^g	No
Mercury	0.03 (<BG)	24 ^b	0.33 ^c	0.33 ^c	No
Molybdenum ^f	0.42	400 ^b	8	-- ^g	No
Nickel	12.5 (<BG)	1,600 ^b	19.1 ^c	27.4	No
Selenium ^h	0.46 (<BG)	400 ^b	5	1	No
Vanadium	41.7 (<BG)	560 ^b	85.1 ^c	-- ^g	No
Zinc	43.0 (<BG)	24,000 ^b	480	67.8 ^c	No

^a The cleanup value of 20 mg/kg has been agreed to by Tri-Party project managers. The basis for 20 mg/kg is provided in Section 2.1.2.1 of the RDR/RAWP (DOE-RL 2005b).

^b Noncarcinogenic cleanup level calculated from WAC 173-340-740(3), Method B, 1996.

^c Where cleanup levels are less than background, cleanup levels default to background (WAC 173-340-700[4][d]) (1996).

^d Calculated based on 100 x MCL x 2 (groundwater to river DAF).

^e Carcinogenic cleanup level calculated based on the inhalation exposure pathway (WAC 173-340-750[3], 1996).

^f No Hanford Site-specific or Washington State background value available.

^g No cleanup level is available from the Cleanup Levels and Risk Calculations database, and no toxicity values are available to calculate cleanup levels (Ecology 2005).

^h Hanford Site-specific background is not available; not evaluated during background study. Value used is from *Natural Background Soil Metals Concentrations in Washington State* (Ecology 1994).

ⁱ A WAC 173-340-740(3) (1996) value for lead is not available. This value is based on the *Guidance Manual for the Integrated Exposure Update Biokinetic Model for Lead in Children* (EPA 1994).

^k Noncarcinogenic cleanup level calculated from WAC 173-340-740(3), 1996 (Method B for soils) (as presented in the RDR/RAWP [DOE-RL 2005b]). Updated oral reference dose values (as provided in IRIS) yield Method B direct exposure RAG values of 16,000 mg/kg and 120,000 mg/kg for barium and chromium, respectively.

^l Barium soil cleanup level for groundwater protection calculated from WAC 173-340-740(3)(a)(ii)(A), 1996 ("100 times rule") and WAC 173-340-720(3), 1996 (Method B for groundwater) is 112 mg/kg (as presented in the RDR/RAWP [DOE-RL-2005b]). The updated oral reference dose value (as provided in IRIS) yields a Method B groundwater cleanup criteria of 7 mg/L, as compared to the more restrictive maximum contaminant level of 2 mg/L (40 CFR 141). Per WAC 173-340-740(3)(a)(ii)(A), 1996 ("100 times rule"), the most restrictive updated soil cleanup level for groundwater protection would be 200 mg/kg.

^m Barium soil cleanup level for river protection calculated from WAC 173-340-740(3)(a)(ii)(A), 1996 ("100 times rule"), a dilution-attenuation factor of 2, and WAC 173-340-720(3), 1996 (Method B for groundwater) is 224 mg/kg (as presented in the RDR/RAWP [DOE-RL 2005b]). No surface water bioconcentration factor is available for barium and no ambient water quality criteria value exists separate from the previous drinking water standard; therefore no WAC 173-340-730(3), 1996 (Method B for surface waters) value can be determined.

**Table 6. Comparison of the Northern 100-C-9:1 Overburden
Maximum Soil Values to Action Levels (2 pages).**

ⁿ Calculated cleanup level (per WAC 173-340-720(3), 1996 [Method B for groundwater] and WAC 173-340-740(3)(a)(ii)(A), 1996 ["100 times rule"]) presented is lower than that presented in the RDR/RAWP (DOE-RL 2005b), based on updated oral reference dose value (as provided in IRIS).

-- = not applicable
 BG = background
 COC = contaminant of concern
 COPC = contaminant of potential concern
 DAF = dilution attenuation factor
 IRIS = Integrated Risk Information System
 MCL = maximum contaminant level
 RAG = remedial action goal
 RDR/RAWP = remedial design report/remedial action work plan
 WAC = Washington Administrative Code

Nonradionuclide risk requirements include an individual hazard quotient of <1.0 , a cumulative hazard quotient of <1.0 , an individual contaminant carcinogenic risk of $<1 \times 10^{-6}$, and a cumulative carcinogenic risk of $<1 \times 10^{-5}$. For the northern section of the 100-C-9:1 subsite, these risk values were conservatively calculated using the higher of the remediation footprint statistical value and the BCL material maximum value for each constituent. These risk values were not calculated for constituents that were either not detected or were detected at concentrations below Hanford Site or Washington State background values. All individual hazard quotients were <1.0 , and all individual excess carcinogenic risk values were $<1 \times 10^{-6}$ (Appendix C). The cumulative hazard quotient for those noncarcinogenic constituents above background is 2.7×10^{-3} , and the cumulative excess carcinogenic risk value for these constituents is 1.8×10^{-7} . These calculations demonstrate that the northern portion of the 100-C-9:1 waste site and staged overburden material meet the requirements specified for the hazard quotients and carcinogenic (excess cancer) risk in the RDR/RAWP (DOE-RL 2005b) and, therefore, the nonradionuclide risk requirements are met.

When using a statistical sampling approach, the application of the WAC 173-340-740(7)(e) three-part test is required. The WAC 173-340-740(7)(e) three-part test is performed for nonradionuclide analytes only and determines if the 95% UCL values exceed the most stringent cleanup limit for each COPC/COC, if more than 10% of the raw data exceed the most stringent cleanup limit for each COPC/COC, and if the maximum values within the raw data set exceed two times the most stringent cleanup limit for each COPC/COC. The application of the three-part test to the northern 100-C-9:1 remediation footprint is included in the site-specific statistical calculations (Appendix C). The three-part test is not applicable to the BCL stockpile results since direct evaluation of the maximum detected sampling results was used as the compliance basis. As demonstrated in the 95% UCL calculation (Appendix C), the northern 100-C-9:1 waste site passes the WAC 173-340-740(7)(e) three-part test in comparison against the most stringent applicable RAGs.

6.3.2 Southern 100-C-9:1 Verification Data Evaluation

Prior to determining the final COC/COPCs for the southern 100-C-9:1 waste site, samples of some of the overburden piles were collected and analyzed for semivolatile organic compounds (SVOCs). Ultimately, SVOCs were determined not to be COCs or COPCs for the 100-C-9:1 site. Detections of polycyclic aromatic hydrocarbons (PAHs, a subset of analytes within the SVOC analysis), occurred in samples of the southern 100-C-9:1 overburden material. The overburden was generated in the vicinity of former roadways, and residual asphaltic fragments within the overburden have resulted in elevated detections of PAHs. A comparison of the statistical PAH concentrations in the verification data set to a known asphalt sample (Table 7) shows a good correlation, as indicated in the ratio column. Asphalt that has been used for structural and construction purposes is excluded from consideration as a dangerous waste in WAC 173-303-071(3)(e), is listed as an inert waste in WAC 173-350-990(2)(b), and does not present a significant risk to human health or the environment. For these reasons, the PAH results will not be considered further in the evaluation of the southern 100-C-9:1 site.

Table 7. Comparison of the Southern 100-C-9:1 Overburden/BCL Stockpile PAH Results to a Known Asphalt Sample.

Analyte	Asphalt Sample Result (mg/kg)	Maximum Overburden/BCL Result (mg/kg)	Ratio (x 10 ⁻⁴)
2-Methylnaphthalene	394	0.071	1.8
Acenaphthene	1,783	0.23	1.3
Anthracene	3,699	0.91	2.5
Benzo(a)anthracene	5,792	1.3	2.2
Benzo(a)pyrene	5,533	0.69	1.2
Benzo(b)fluoranthene	4,619	0.72	1.6
Benzo(g,h,i)perylene	2,839	0.25	0.9
Benzo(k)fluoranthene	4,527	0.67	1.5
Carbazole	2,049	0.65	3.2
Chrysene	5,580	1.4	2.5
Dibenzo(a,h)anthracene	1,531	0.15	1.0
Dibenzofuran	1,135	0.20	1.8
Fluoranthene	10,665	2.4	2.3
Fluorene	1,756	0.44	2.5
Indeno(1,2,3-cd) pyrene	2,751	0.28	1.0
Naphthalene	1,917	0.097	0.5
Phenanthrene	10,975	2.3	2.1
Pyrene	10,205	2.1	2.1

BCL = below cleanup levels

PAH = polycyclic aromatic hydrocarbons

Residual concentrations of the COCs and COPCs in the southern 100-C-9:1 excavation and stockpiles were all below the applicable RAGs, with the exception of the total chromium and mercury results in the excavation footprint (Table 8) and the beryllium and copper results in the stockpiles (Table 9). The total chromium result fails the WAC 173-340-740(7)(e) three-part test because one of the samples exceeds one of the applicable RAGs by more than two-fold. RESRAD modeling (BHI 2005a) shows that, with a groundwater table elevation of 120 m (394 ft) and a clean zone extending from groundwater to an elevation of 141 m (463 ft), the total chromium, mercury, beryllium, and copper will not reach groundwater or the river within 1,000 years, and therefore meet the remedial action objectives (RAOs).

Nonradionuclide risk requirements include an individual hazard quotient of < 1.0 , a cumulative hazard quotient of < 1.0 , an individual contaminant carcinogenic risk of $< 1 \times 10^{-6}$, and a cumulative carcinogenic risk of $< 1 \times 10^{-5}$. For the southern 100-C-9:1 subsite, these risk values were calculated using the higher of the remediation footprint statistical value and the BCL material maximum value for each constituent. Risk values were not calculated for constituents that were not detected, were detected at concentrations below Hanford Site or Washington State background values, or were the result of asphalt cross-contamination of the sample matrices. Further discussion of the 100-C-9:1 hazard calculation can be found in the southern 95% UCL calculation (Appendix C). All individual hazard quotients were < 1.0 , and all individual excess carcinogenic risk values were $< 1 \times 10^{-6}$. The cumulative hazard quotient for those noncarcinogenic constituents above background or detection levels is 9.8×10^{-1} , and the cumulative excess carcinogenic risk value for these constituents is 1.0×10^{-6} . Therefore, nonradionuclide risk requirements are met.

When using a statistical sampling approach, a requirement is the application of the WAC 173-340-740(7)(e) three-part test. The WAC 173-340-740(7)(e) three-part test is performed for nonradionuclide analytes only and determines if the 95% UCL values exceed the most stringent cleanup limit for each COPC/COC, if more than 10% of the raw data exceed the most stringent cleanup limit for each COPC/COC, and if the maximum values within the raw data set exceed two times the most stringent cleanup limit for each COPC/COC. The application of the three-part test to the southern 100-C-9:1 remediation footprint data is included in the site-specific statistical calculations. The three-part test is not applicable to the stockpile results since direct evaluation of the maximum detected sampling results was used as the compliance basis. As demonstrated in the 95% UCL calculation (Appendix C) the southern 100-C-9:1 waste site passes the WAC 173-340-740(7)(e) three-part test for direct exposure. However, mercury and chromium required further evaluation because the groundwater and/or river protection RAGs were exceeded. As previously described, further evaluation by RESRAD modeling (BHI 2005a) found the residual concentrations of mercury and chromium to be protective of groundwater and the river. Therefore, the RAOs for the southern portion of 100-C-9:1 have been met.

7.0 DATA QUALITY ASSESSMENTS

Individual data quality assessments (DQAs) were performed for each sampling event, and are included in Appendix D. Each DQA was performed to compare the sampling approach and

**Table 8. Comparison of the Southern 100-C-9:1 Excavation Footprint
Statistical Soil Values to Action Levels. (2 Pages)**

COC/COPC	Statistical Result (mg/kg)	Remedial Action Goals ^a (mg/kg)			Does the Statistical Data Set Exceed RAGs?	Does the Statistical Result Pass RESRAD Modeling?
		Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
Antimony ^b	0.62 (<BG)	32 ^m	5 ^c	5 ^c	No	--
Arsenic	5.0 (<BG)	20 ^p	20 ^p	20 ^p	No	--
Barium	75.9 (<BG)	5,600 ^d	132 ^{c,e}	224 ^f	No	--
Beryllium	0.40 (<BG)	10.4 ^g	1.51 ^c	1.51 ^c	No	--
Boron ^h	1.0	7,200 ^m	320	-- ⁱ	No	--
Cadmium ^b	0.26 (<BG)	13.9 ^g	0.81 ^c	0.81 ^c	No	--
Chromium (total)	15.9 (<BG)	80,000 ^d	18.5 ^c	18.5 ^c	Yes ^j	Yes ^k
Chromium (hexavalent)	1.8	2.1 ^g	4.8 ^l	2	No	--
Cobalt	9.7 (<BG)	1,600 ^m	32	-- ⁱ	No	--
Copper	18.0 (<BG)	2,960 ^m	59.2	22.0 ^c	No	--
Lead	6.4 (<BG)	353 ⁿ	10.2 ^c	10.2 ^c	No	--
Manganese	400 (<BG)	11,200 ^m	512 ^c	-- ⁱ	No	--
Mercury	22.7	24 ^m	0.33 ^c	0.33 ^c	Yes	Yes ^k
Molybdenum ^h	0.32	400 ^m	8	-- ⁱ	No	--
Nickel	12.8 (<BG)	1,600 ^m	19.1 ^c	27.4	No	--
Vanadium	48.9 (<BG)	560 ^m	85.1 ^c	-- ⁱ	No	--
Zinc	48.2 (<BG)	24,000 ^m	480	67.8 ^c	No	--

^a Lookup values and remedial action goals (RAGs) obtained from the *100 Area Remedial Action Sampling and Analysis Plan* (DOE-RL 2005a) or calculated per (WAC 173-340-720, 730, and 740, Method B, 1996, unless otherwise noted.

^b Hanford Site-specific background value is not available; not evaluated during background study. Value used is from *Natural Background Soil Metals Concentrations in Washington State* (Ecology 1994).

^c Where cleanup levels are less than background, cleanup levels default to background (WAC 173-340-700[4][d]) (1996).

^d Noncarcinogenic cleanup level calculated from WAC 173-340-740(3), 1996 (Method B for soils) (as presented in the RDR/RAWP [DOE-RL 2005b]). Updated oral reference dose values (as provided in IRIS) yield Method B direct exposure RAG values of 16,000 mg/kg and 120,000 mg/kg for barium and chromium, respectively.

^e Barium soil cleanup level for groundwater protection calculated from WAC 173-340-740(3)(a)(ii)(A), 1996 ("100 times rule") and WAC 173-340-720(3), 1996 (Method B for groundwater) is 112 mg/kg (as presented in the RDR/RAWP [DOE-RL 2005b]). The updated oral reference dose value (as provided in IRIS) yields a Method B groundwater cleanup criteria of 7 mg/L, as compared to the more restrictive maximum contaminant level of 2 mg/L (40 CFR 141). Per WAC 173-340-740(3)(a)(ii)(A), 1996 ("100 times rule"), the most restrictive updated soil cleanup level for groundwater protection would be 200 mg/kg.

^f Barium soil cleanup level for river protection calculated from WAC 173-340-740(3)(a)(ii)(A), 1996 ("100 times rule"), a dilution-attenuation factor of 2, and WAC 173-340-720(3), 1996 (Method B for groundwater) is 224 mg/kg (as presented in the RDR/RAWP [DOE-RL 2005b]). No surface water bioconcentration factor is available for barium and no AWQC value exists separate from the previous drinking water standard; therefore no WAC 173-340-730(3), 1996 (Method B for surface waters) value can be determined.

^g Carcinogenic cleanup level calculated based on the inhalation exposure pathway per WAC 173-340-750[3], 1996 (Method B for air quality) and an airborne particulate mass loading rate of 0.0001 g/m³ (WDOH 1997).

^h No Hanford Site-specific or Washington State background value available.

ⁱ No parameters are available from the Ecology Cleanup Levels and Risk Calculations database (Ecology 2005), and no bioconcentration factor or AWQC values are available to calculate cleanup levels (WAC 173-340-730(3)(a)(iii), 1996 [Method B for surface waters]).

Table 8. Comparison of the Southern 100-C-9:1 Excavation Footprint Statistical Soil Values to Action Levels. (2 Pages)

- ^j The statistical verification data set for total chromium fails the second component of the WAC 173-340-740(7)(e) 3-part test in comparison against soil RAGs for groundwater and river protection (one or more sample concentrations exceeds twice the soil RAG value).
- ^k Contaminant will not reach groundwater (and thus the Columbia River) based on the *100 Area Analogous Sites RESRAD Calculations* (BHI 2005a), with a groundwater table elevation of 120 m (394 ft) and a clean zone extending from groundwater to an elevation of 141 m (463 ft).
- ^l Calculated cleanup level (per WAC 173-340-720(3), 1996 [Method B for groundwater] and WAC 173-340-740(3)(a)(ii)(A), 1996 ["100 times rule"]) presented is lower than that presented in the RDR/RAWP (DOE-RL 2005b), based on updated oral reference dose value (as provided in IRIS).
- ^m Noncarcinogenic cleanup level calculated from WAC 173-340-740(3), Method B, 1996.
- ⁿ A WAC 173-340-740(3) (1996) value for lead is not available. This value is based on the *Guidance Manual for the Integrated Exposure Update Biokinetic Model for Lead in Children* (EPA 1994).
- ^p The cleanup value of 20 mg/kg has been agreed to by Tri-Party project managers. The basis for 20 mg/kg is provided in Section 2.1.2.1 of the RDR/RAWP (DOE-RL 2005b).
- = not applicable
- AWQC = ambient water quality criteria
- BCL = below cleanup levels
- BG = background (obtained from DOE-RL [2001], unless otherwise noted)
- CFR = Code of Federal Regulations
- COC = contaminant of concern
- COPC = contaminant of potential concern
- IRIS = Integrated Risk Information System
- RAG = remedial action goal
- RDR/RAWP = remedial design report/remedial action work plan
- RESRAD = RESidual RADioactivity (dose-assessment model)
- WAC = Washington Administrative Code

Table 9. Comparison of the Overburden/BCL Stockpiles Maximum Contaminant Concentrations to Action Levels for the 100-C-9:1 (South) Sampling Events. (2 Pages)

COC/COPC	Maximum Result (mg/kg)	Remedial Action Goals ^a (mg/kg)			Does the Statistical Data Set Exceed RAGs?	Does the Statistical Result Pass RESRAD Modeling?
		Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
Antimony ^b	1.4 (<BG)	32 ^m	5 ^c	5 ^c	No	--
Arsenic	5.3 (<BG)	20 ^q	20 ^q	20 ^q	No	--
Barium	78.1 (<BG)	5,600 ^d	132 ^{c,e}	224 ^f	No	--
Beryllium	1.8	10.4 ^g	1.51 ^c	1.51 ^c	Yes	Yes ^k
Boron ^h	1.8	7,200 ^m	320	-- ⁱ	No	--
Cadmium ^b	0.26 (<BG)	13.9 ⁿ	0.81 ^c	0.81 ^c	No	--
Chromium (total)	15.4 (<BG)	80,000 ^d	18.5 ^c	18.5 ^c	No	--
Chromium (hexavalent)	0.39	2.1 ⁿ	4.8 ^l	2	No	--
Cobalt	11.5 (<BG)	1,600 ^m	32	-- ⁱ	No	--
Copper	26.5	2,960 ^m	59.2	22.0 ^c	Yes	Yes ^k
Lead	6.8 (<BG)	353 ^p	10.2 ^c	10.2 ^c	No	--
Manganese	390 (<BG)	11,200 ^m	512 ^c	-- ⁱ	No	--
Mercury	0.04 (<BG)	24 ^m	0.33 ^c	0.33 ^c	No	--

Table 9. Comparison of the Overburden/BCL Stockpiles Maximum Contaminant Concentrations to Action Levels for the 100-C-9:1 (South) Sampling Events. (2 Pages)

COC/COPC	Maximum Result (mg/kg)	Remedial Action Goals ^a (mg/kg)	Does the Statistical Data Set Exceed RAGs?	Does the Statistical Result Pass RESRAD Modeling?	COC/COPC	Maximum Result (mg/kg)
Molybdenum ^h	0.80	400 ^m	8	-- ⁱ	No	--
Nickel	14.9 (<BG)	1,600 ^m	19.1 ^c	27.4	No	--
Vanadium	65.0 (<BG)	560 ^m	85.1 ^c	-- ⁱ	No	--
Zinc	65.1 (<BG)	24,000 ^m	480	67.8 ^c	No	--

^a Lookup values and remedial action goals (RAGs) obtained from the *100 Area Remedial Action Sampling and Analysis Plan* (DOE-RL 2005a) or calculated per WAC 173-340-720, 730, and 740, Method B, 1996, unless otherwise noted.

^b Hanford Site-specific background value is not available; not evaluated during background study. Value used is from *Natural Background Soil Metals Concentrations in Washington State* (Ecology 1994).

^c Where cleanup levels are less than background, cleanup levels default to background (WAC 173-340-700[4][d]) (1996).

^d Noncarcinogenic cleanup level calculated from WAC 173-340-740(3), 1996 (Method B for soils) (as presented in the RDR/RAWP [DOE-RL 2005b]). Updated oral reference dose values (as provided in IRIS) yield Method B direct exposure RAG values of 16,000 mg/kg and 120,000 mg/kg for barium and chromium, respectively.

^e Barium soil cleanup level for groundwater protection calculated from WAC 173-340-740(3)(a)(ii)(A), 1996 ("100 times rule") and WAC 173-340-720(3), 1996 (Method B for groundwater) is 112 mg/kg (as presented in the RDR/RAWP [DOE-RL 2005b]). The updated oral reference dose value (as provided in IRIS) yields a Method B groundwater cleanup criteria of 7 mg/L, as compared to the more restrictive maximum contaminant level of 2 mg/L (40 CFR 141). Per WAC 173-340-740(3)(a)(ii)(A), 1996 ("100 times rule"), the most restrictive updated soil cleanup level for groundwater protection would be 200 mg/kg.

^f Barium soil cleanup level for river protection calculated from WAC 173-340-740(3)(a)(ii)(A), 1996 ("100 times rule"), a dilution-attenuation factor of 2, and WAC 173-340-720(3), 1996 (Method B for groundwater) is 224 mg/kg (as presented in the RDR/RAWP [DOE-RL 2005b]). No surface water bioconcentration factor is available for barium and no AWQC value exists separate from the previous drinking water standard; therefore no WAC 173-340-730(3), 1996 (Method B for surface waters) value can be determined.

^g Carcinogenic cleanup level calculated based on the inhalation exposure pathway per WAC 173-340-750[3], 1996 (Method B for air quality) and an airborne particulate mass loading rate of 0.0001 g/m³ (WDOH 1997).

^h No Hanford Site-specific or Washington State background value available.

ⁱ No parameters are available from the Cleanup Levels and Risk Calculations database (Ecology 2005), and no bioconcentration factor or AWQC values are available to calculate cleanup levels (WAC 173-340-730(3)(a)(iii), 1996 [Method B for surface waters]).

^j The statistical verification data set for total chromium fails the second component of the WAC 173-340-740(7)(e) 3-part test in comparison against soil RAGs for groundwater and river protection (one or more sample concentrations exceeds twice the soil RAG value).

^k Contaminant will not reach groundwater (and thus the Columbia River) based on the *100 Area Analogous Sites RESRAD Calculations* (BHI 2005a), with a groundwater table elevation of 120 m (394 ft) and a clean zone extending from groundwater to an elevation of 141 m (463 ft).

^l Calculated cleanup level (per WAC 173-340-720(3), 1996 [Method B for groundwater] and WAC 173-340-740(3)(a)(ii)(A), 1996 ["100 times rule"]) presented is lower than that presented in the RDR/RAWP (DOE-RL 2005b), based on updated oral reference dose value (as provided in IRIS).

^m Noncarcinogenic cleanup level calculated from WAC 173-340-740(3), Method B, 1996.

ⁿ Carcinogenic cleanup level calculated based on the inhalation exposure pathway (WAC 173-340-750[3], 1996).

^p A WAC 173-340-740(3) (1996) value for lead is not available. This value is based on the *Guidance Manual for the Integrated Exposure Update Biokinetic Model for Lead in Children* (EPA 1994).

^q The cleanup value of 20 mg/kg has been agreed to by Tri-Party project managers. The basis for 20 mg/kg is provided in Section 2.1.2.1 of the RDR/RAWP (DOE-RL 2005b).

-- = not applicable

BCL = below cleanup levels

BG = background (obtained from DOE-RL [2001], unless otherwise noted)

CFR = Code of Federal Regulations

COC = contaminant of concern

COPC = contaminant of potential concern

IRIS = Integrated Risk Information System

RAG = remedial action goal

RESRAD = RESidual RADioactivity (dose-assessment model)

RDR/RAWP = remedial design report/remedial action work plan

WAC = Washington Administrative Code

resulting analytical data with the sampling and data requirements specified in the site-specific work instructions. All DQAs were performed in accordance with specific data quality objectives found in the SAP (DOE-RL 2005a). The data quality requirements in the SAP are used for assessing data resulting from statistical sampling and do not specifically apply to the data sets resulting from the (confirmatory) focused sampling performed for the 100-C-9:1 subsite. However, to ensure quality data sets, the SAP data quality assurance requirements, as well as the data validation procedures for chemical and radiochemical analysis (BHI 2000a, 2000b), have been followed where appropriate.

The DQAs involve evaluation of the data to determine if they are of the right type, quality, and quantity to support the intended use (i.e., closeout decisions). A DQA completes the data life cycle (i.e., planning, implementation, and assessment) initiated by the data quality objectives process (EPA 2000). It was concluded that the interim closure data was of the right quality and quantity to support a closeout decision for the 100-C-9:1 waste site.

All analytical data are stored in the ENRE project-specific database prior to being submitted for inclusion in the HEIS database. The confirmatory sample analytical data are also summarized in Appendix A, and verification sample data are included with the calculations provided in Appendix C.

8.0 SUMMARY FOR INTERIM CLOSURE

The northern and southern portions of the 100-C-9:1 waste subsite have been remediated and evaluated in accordance with the Remaining Sites ROD (EPA 1999) and the RDR/RAWP (DOE-RL 2005b). Where the contamination associated with this site occurred in the shallow zone, the twin box culvert and associated contaminated soils have been removed and disposed of at ERDF. It was determined that the deep zone portion of the twin box culvert met the applicable remedial action objectives and was left in place. Sampling to verify the completeness of remedial activities in the shallow zone was performed. The analytical results meet the remedial action objectives for direct exposure, groundwater protection, and river protection. In accordance with this evaluation, the verification sampling results support a reclassification of the 100-C-9:1 site to Interim Closed Out. The deep zone component of this site will require institutional controls to prevent uncontrolled drilling/excavation.

9.0 REFERENCES

40 CFR 141, "National Primary Drinking Water Regulations," *Code of Federal Regulations*, as amended.

ANL, 2002, *RESRAD for Windows*, Version 6.21, Argonne National Laboratory, Environmental Assessment Division, Argonne, Illinois.

BHI, 2000a, *Data Validation Procedure for Chemical Analysis*, BHI-01435, Rev. 0, Bechtel Hanford, Inc., Richland, Washington.

BHI, 2000b, *Data Validation Procedure for Radiochemical Analysis*, BHI-01433, Rev. 0, Bechtel Hanford, Inc., Richland, Washington.

BHI, 2001, *Calculation of Total Uranium Activity Corresponding to a Maximum Contaminant Level for Total Uranium of 30 Micrograms per Liter in Groundwater*, 0100X-CA-V0038, Rev. 0, Bechtel Hanford, Inc., Richland, Washington.

BHI, 2002, *Cleanup Verification Package for the 116-B-7, 132-B-6, and 132-C-2 B/C Outfalls*, CVP-2002-00003, Rev. 0, Bechtel Hanford, Inc., Richland, Washington.

BHI, 2003a, *Waste Site Evaluation for 100-C-9:1 Main Process Sewer (Twin Box Sewer) (100-C-9 Process and Sanitary Sewer Underground Pipelines)*, 0100B-CA-V0183, Rev. 0, Bechtel Hanford, Inc., Richland, Washington.

BHI, 2003b, *Remaining Sites Field Sampling*, Logbook EL-1578-1, Bechtel Hanford, Inc., Richland, Washington.

BHI, 2003c, *Waste Site Evaluation for 100-C-9:1 Main Process Sewer (Twin Box Sewer) (100-C-9 Process and Sanitary Sewer Underground Pipeline)*, 0100B-CA-V0183, Rev. 0, Bechtel Hanford, Inc., Richland, Washington.

BHI, 2004a, *100 Area Radionuclide and Nonradionuclide Lookup Values for the 1995 Interim Remedial Action Record of Decision*, 0100X-CA-V0046, Rev. 0, Bechtel Hanford Inc., Richland, Washington.

BHI, 2004b, *100 BC Box Culvert Sampling*, CCN 117558, email from A. R. Michael to J. G. April, dated November 4, 2004, Bechtel Hanford, Inc., Richland, Washington.

BHI, 2004c, *Remaining Site Field Sampling*, Logbook EL-1585, Bechtel Hanford, Inc., Richland, Washington.

BHI, 2004d, *Pipe and Matrix Reduction Calculations*, 0100B-CA-V0209, Rev. 0, Bechtel Hanford, Inc., Richland, Washington.

BHI, 2004e, *100-C-9:1 B1/B2 Main Process Sewer RESRAD Calculation Brief*, 0100B-CA-V0240, Rev. 0, Bechtel Hanford, Inc. Richland, Washington.

BHI, 2005a, *100 Area Analogous Sites RESRAD Calculations*, 0100X-CA-V0050, Rev. 0, Bechtel Hanford, Inc., Richland, Washington.

BHI, 2005b, *Work Instruction for Verification Sampling of the Northern Portion of the 100-C-9:1 Main Process Sewer Pipeline (Twin Box Culvert)*, 0100B-WI-G0006, Rev. 0, Bechtel Hanford, Inc. Richland, Washington.

DOE Order 5400.5, *Radiation Protection of the Public and Environment*, as amended, U.S. Department of Energy, Washington, D.C.

- DOE-RL, 1995, *Hanford Site Risk Assessment Methodology*, DOE/RL-91-45, Rev. 3, U.S. Department of Energy, Richland Operations Office, Richland, Washington.
- DOE-RL, 1996, *Hanford Site Background: Part 2, Soil Background for Radionuclides*, DOE/RL-96-12, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.
- DOE-RL, 2001, *Hanford Site Background: Part 1, Soil Background for Nonradioactive Analytes*, DOE/RL-92-24, Rev. 4, U.S. Department of Energy, Richland Operations Office, Richland, Washington.
- DOE-RL, 2005a, *100 Area Remedial Action Sampling and Analysis Plan*, DOE/RL-96-22, Rev. 4, U.S. Department of Energy, Richland Operations Office, Richland, Washington.
- DOE-RL, 2005b, *Remedial Design Report/Remedial Action Work Plan for the 100 Area*, DOE/RL-96-17, Rev. 5, U.S. Department of Energy, Richland Operations Office, Richland, Washington.
- DOE-RL, 2007, *Tri-Party Agreement Handbook Management Procedures*, RL-TPA-90-0001, Guideline Number TPA-MP-14, Rev. 1, "Maintenance of the Waste Information Data System (WIDS)," U.S. Department of Energy, Richland Operations Office, Richland, Washington.
- Ecology, 1994, *Natural Background Soil Metals Concentrations in Washington State*, Publication No. 94-115, Washington State Department of Ecology, Olympia, Washington.
- Ecology, 1995, *Guidance on Sampling and Data Analysis Methods*, Publication No. 94-49, Washington State Department of Ecology, Olympia, Washington.
- Ecology, 1996, *Model Toxic Control Act Cleanup Levels and Risk Calculations (CLARC II)*, Publication #94-145, Washington State Department of Ecology, Olympia, Washington.
- Ecology, 2005, *Cleanup Levels and Risk Calculations (CLARC) Database*, Washington State Department of Ecology, Olympia, Washington, <<https://fortress.wa.gov/ecy/clarc/CLARCHome.aspx>>.
- ENV-1, *Environmental Monitoring and Management*, Washington Closure Hanford, Richland, Washington.
- EPA, 1989, *Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual (Part A)*, EPA/540/1-89/002, U.S. Environmental Protection Agency, Washington, D.C.

- EPA, 1994, *Guidance Manual for the Integrated Exposure Update Biokinetic Model for Lead in Children*, EPA/540/R-93/081, Publication No. 9285.7, U.S. Environmental Protection Agency, Washington, D.C.
- EPA, 1999, *Interim Action Record of Decision for the 100-BC-1, 100-BC-2, 100-DR-1, 100-DR-2, 100-FR-1, 100-FR-2, 100-HR-1, 100-HR-2, 100-KR-1, 100-KR-2, 100-IU-2, 100-IU-6, and 200-CW-3 Operable Units, Hanford Site, Benton County, Washington*, U.S. Environmental Protection Agency, Region 10, Seattle, Washington.
- EPA, 2000, *Guidance for Data Quality Assessment, EPA QA/G-9, QA00 Update*, U.S. Environmental Protection Agency, Office of Environmental Information, Washington, D.C.
- Feist, E. T., 2004, *100-B/C-1 and 100-B/C-2 Operable Units Remaining Sites for Remedial Action*, CCN 112480, Interoffice Memorandum to R. A. Carlson, dated May 28, 2004, Bechtel Hanford, Inc., Richland, Washington.
- WAC 173-303, 2004, "Dangerous Waste Regulations," *Washington Administrative Code*.
- WAC 173-340, 1996, "Model Toxics Control Act -- Cleanup," *Washington Administrative Code*.
- WAC 173-350, 2005, "Solid Waste Handling Standards," *Washington Administrative Code*.
- WCH, 2005, *100-C-9:1 (North) Hazard Quotient and Carcinogenic Risk Calculations*, 0100C-CA-V0026, Washington Closure Hanford, Richland, Washington.
- WCH, 2005a, *Backfill Concurrence for 100-C-9:1(North), Northern Process Sewer Main*, CCN 0569123, Washington Closure Hanford, Richland, Washington.
- WCH, 2006a, *100 B/C Remaining Pipelines and Sewers Sampling and Field Services*, Logbook EL-1585-6, Washington Closure Hanford, Richland, Washington.
- WCH, 2006b, *100 B/C Remaining Pipelines and Sewers Sampling and Field Services*, Logbook EL-1585-7, Washington Closure Hanford, Richland, Washington.
- WCH, 2006c, *Work Instruction for Verification Sampling of the Southern Portion of the 100-C-9:1 Main Process Sewer Pipeline (Twin Box Culvert)*, 0100B-WI-G0018, Rev. 0, Washington Closure Hanford, Richland, Washington.
- WCH, 2006d, *Backfill Concurrence Checklist – Waste Site 100-C-9:1(South), Southern Process Sewer Main*, CCN 0576982, Washington Closure Hanford, Richland, Washington.
- WCH, 2006e, *100-C-9:1 (South) Waste Site Cleanup Verification 95% UCL Calculations*, 0100C-CA-V0029, Washington Closure Hanford, Richland, Washington.

WCH, 2006f, *Using RESRAD to Evaluate Hexavalent Chromium and Mercury in the 100-C-9:1 Box Culvert Concrete for Groundwater Protection*, CCN 128323, Washington Closure Hanford, Richland, Washington.

WCH, 2007a, *Backup RESRAD Calculations Output for CCN 128323 "Using RESRAD to Evaluate Hexavalent Chromium and Mercury in the 100-C-9:1 Box Culvert Concrete for Groundwater Protection,"* CCN 133053, Washington Closure Hanford, Richland, Washington.

WDOH, 1997, *State of Washington Department of Health Interim Regulatory Guidance: Hanford Guidance for Radiological Cleanup*, WDOH/320-015, Rev. 1, Washington Department of Health, Olympia, Washington.

APPENDIX A

**CONFIRMATORY AND IN-PROCESS SAMPLING ANALYTICAL
RESULTS**

Note: Verification sampling results and calculations to support reclassification of the 100-C-9:1 subsite to Interim Closed Out are provided in Appendix C.

Table A-1. Confirmatory Sampling Results 100-C-9:1 North and South (6 pages)

Sample Area	HEIS Number	Sample Date	Americium-241 GEA			Cesium-137			Cobalt-60			Europium-152			Europium-154			Europium-155		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
Soil (B2)	J00YP7	09/30/03	0.1	U	0.1	0.425		0.035	0.047		0.044	0.683		0.068	0.09	U	0.09	0.085	U	0.085
Soil (B4)	J00YP8	10/17/03	0.18	U	0.18	0.085	U	0.085	0.055	U	0.055	0.18	U	0.18	0.24	U	0.24	0.17	U	0.17
Duplicate of J00YP7	J00YR0	09/30/03	0.19	U	0.19	0.346		0.042	0.038	U	0.038	0.529		0.089	0.14	U	0.14	0.096	U	0.096
Scale (B1)	J00YP2	09/30/03	0.12	U	0.12	4.68		0.047	0.053		0.026	6.36		0.085	0.769		0.1	0.12	U	0.12
Scale (B3)	J00YP3	10/13/03	0.49	U	0.49	8.08		0.066	0.039	U	0.039	0.652		0.15	0.14	U	0.14	0.17	U	0.17

Sample Area	HEIS Number	Sample Date	Gross Alpha			Gross Beta			Potassium-40			Radium-226			Radium-228			Thorium-228 GEA		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
Soil (B2)	J00YP7	09/30/03	6.21		3	13.5		7.2	14		0.21	0.376		0.053	0.627		0.13	0.477		0.034
Soil (B4)	J00YP8	10/17/03	6.92		3.7	16.5		6.2	6.41		0.78	0.248		0.13	0.811		0.25	0.436		0.097
Duplicate of J00YP7	J00YR0	09/30/03	3.57		3.3	15.9		5.4	13.6		0.25	0.359		0.072	0.55		0.18	0.462		0.047
Scale (B1)	J00YP2	09/30/03	0.835	U	4.8	17.2		6.5	9.13		0.2	0.605		0.07	0.631		0.13	0.555		0.046
Scale (B3)	J00YP3	10/13/03	4.46	U	5.8	16.3		7.6	7.75		0.41	0.761		0.1	0.764		0.16	0.684		0.076

Sample Area	HEIS Number	Sample Date	Thorium-232 GEA			Uranium-235 GEA			Uranium-238 GEA		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
Soil (B2)	J00YP7	09/30/03	0.627		0.13	0.1	U	0.1	4	U	4
Soil (B4)	J00YP8	10/17/03	0.811		0.25	0.27	U	0.27	9.8	U	9.8
Duplicate of J00YP7	J00YR0	09/30/03	0.55		0.18	0.13	U	0.13	4.8	U	4.8
Scale (B1)	J00YP2	09/30/03	0.631		0.13	0.13	U	0.13	4.8	U	4.8
Scale (B3)	J00YP3	10/13/03	0.764		0.16	0.22	U	0.22	4.9	U	4.9

*Acronyms below apply to all Appendix A tables.

Acronyms	
B	= blank contamination
C	= low-level detect
D	= diluted
GEA	= gamma energy analysis
HEIS	= Hanford Environmental Information System
I	= interference during analysis
J	= estimate
MDA	= minimum detectable activity
OS	= other solids
PQL	= practical quantitation limit
Q	= qualifier
SVOA	= semivolatle organic analyses
TCLP	= toxicity characteristic leachate procedure
U	= undetected

Table A-1. Confirmatory Sampling Results 100-C-9:1 North and South (6 pages)

Sample Area	HEIS Number	Sample Date	Aluminum			Antimony			Arsenic			Barium			Beryllium			Boron		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
Soil (B2)	J00YP7	09/30/03	6720		4.7	0.89		0.29	4		0.42	73.9		0.02	0.29		0.04	1.2		0.22
Soil (B4)	J00YP8	10/17/03	5200		4.5	0.28	U	0.28	2.9		0.41	65.8		0.02	0.27		0.04	0.78		0.21
Equipment Blank	J00YP9	09/30/03	66.8		4.2	0.26	U	0.26	0.38	U	0.38	1.4		0.02	0.04	U	0.04	0.2	U	0.2
Duplicate of J00YP7	J00YR0	09/30/03	6820		4.6	0.81		0.28	4.6		0.41	74.4		0.02	0.26		0.04	1.1		0.21
Scale (B1)	J00YP2	09/30/03	12100		4.6	5.1		0.28	14.9		0.41	119		0.02	0.47		0.04	6.6		0.21
Scale (B3)	J00YP3	10/13/03	17700		4.8	2.8		0.3	18.5		0.43	90		0.02	0.08		0.04	6.8		0.22

Sample Area	HEIS Number	Sample Date	Cadmium			Calcium			Chromium			Cobalt			Copper			Hexavalent Chromium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
Soil (B2)	J00YP7	09/30/03	0.04	U	0.04	11700		3.1	91.4		0.1	6		0.12	285		0.12	16.2		0.8
Soil (B4)	J00YP8	10/17/03	0.04	U	0.04	7000		3	5.8		0.1	12.5		0.12	16.4		0.12	0.41	U	0.41
Equipment Blank	J00YP9	09/30/03	0.04	U	0.04	42.9		2.8	0.13		0.09	0.11	U	0.11	0.11		0.11	0.4	U	0.4
Duplicate of J00YP7	J00YR0	09/30/03	0.04	U	0.04	9510		3	72.9		0.1	6.1		0.12	361		0.12	3.83		0.4
Scale (B1)	J00YP2	09/30/03	2.7		0.04	31100		3	1340		0.1	8.6		0.12	62.8		0.12			
Scale (B3)	J00YP3	10/13/03	5.5		0.04	18900		3.2	366		0.1	8		0.12	51		0.12			
Scale (B1)	J00YP4	09/30/03																352		0.35
Scale (B3)	J00YP5	10/13/03																103		0.35

Sample Area	HEIS Number	Sample Date	Iron			Lead			Magnesium			Manganese			Mercury			Molybdenum		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
Soil (B2)	J00YP7	09/30/03	17000		2	146		0.19	4380		0.7	285		0.03	4.5		0.16	0.33		0.19
Soil (B4)	J00YP8	10/17/03	32600		1.9	4.1		0.18	5300		0.68	410		0.03	0.02	U	0.02	0.64		0.18
Equipment Blank	J00YP9	09/30/03	178		1.8	0.35		0.17	10.6		0.64	3		0.03	0.02	U	0.02	0.17	U	0.17
Duplicate of J00YP7	J00YR0	09/30/03	16900		1.9	164		0.19	4620		0.68	319		0.03	3.2		0.08	0.27		0.19
Scale (B1)	J00YP2	09/30/03	26800		1.9	20.9		0.18	16400		0.68	550		0.03	51.7		0.82	0.83		0.18
Scale (B3)	J00YP3	10/13/03	27900		2	46		0.19	20500		0.72	522		0.03	173		3.3	1.6		0.19

Table A-1. Confirmatory Sampling Results 100-C-9:1 North and South (6 pages)

Sample Area	HEIS Number	Sample Date	Nickel			Potassium			Selenium			Silicon			Silver			Sodium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
Soil (B2)	J00YP7	09/30/03	14.1		0.2	1360		2.3	0.29	U	0.29	301		0.54	0.08	U	0.08	283		0.71
Soil (B4)	J00YP8	10/17/03	10		0.19	946		2.3	0.28	U	0.28	406		0.53	0.2		0.08	280		0.69
Equipment Blank	J00YP9	09/30/03	0.18	U	0.18	25.2		2.1	0.26	U	0.26	51.4		0.49	0.07	U	0.07	6.9		0.65
Duplicate of J00YP7	J00YR0	09/30/03	15.8		0.2	1310		2.3	0.28	U	0.28	281		0.53	0.08	U	0.08	276		0.69
Scale (B1)	J00YP2	09/30/03	15.1		0.19	1660		2.3	0.28	U	0.28	573		0.52	0.08	U	0.08	2170		0.52
Scale (B3)	J00YP3	10/13/03	29.5		0.2	1550		2.4	0.34		0.3	320		0.55	0.32		0.08	2130		0.55

Sample Area	HEIS Number	Sample Date	Sulfate			Vanadium			Zinc			pH Measurement
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	
Soil (B2)	J00YP7	09/30/03	71.5		6.3	35.8		0.09	57.5		0.26	9.2
Soil (B4)	J00YP8	10/17/03	20.7		1.3	87.7		0.09	57.8		0.25	9
Equipment Blank	J00YP9	09/30/03	1.3		1.2	0.11		0.08	0.67		0.24	
Duplicate of J00YP7	J00YR0	09/30/03	58.2		6.3	34.9		0.09	52.3		0.25	9.1
Scale (B1)	J00YP2	09/30/03	1060		63.6	70		0.09	326		0.25	8.7
Scale (B3)	J00YP3	10/13/03	3330		261	69		0.09	506		0.27	9.5

Table A-1. Confirmatory Sampling Results 100-C-9:1 North and South (6 pages)

Constituent	J00YP2 Sample Area B1 Sample Date 9/30/03			J00YP3 Sample Area B3 Sample Date 10/13/03			J00YP7 Sample Area B2 Sample Date 9/30/03			J00YP8 Sample Area B4 Sample Date 10/17/03			J00YP9 Duplicate of B2 Sample Date 9/30/03			J00YR0 Equipment Blank Sample Date 9/30/03		
	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL
Polychlorinated Biphenyls																		
Aroclor-1016	14	U	14	14	U	14	13	U	13	13	U	13	13	U	13	13	U	13
Aroclor-1221	14	U	14	14	U	14	13	U	13	13	U	13	13	U	13	13	U	13
Aroclor-1232	14	U	14	14	U	14	13	U	13	13	U	13	13	U	13	13	U	13
Aroclor-1242	14	U	14	14	U	14	13	U	13	13	U	13	13	U	13	13	U	13
Aroclor-1248	14	U	14	14	U	14	13	U	13	13	U	13	13	U	13	13	U	13
Aroclor-1254	15		14	14	U	14	13	U	13	13	U	13	13	U	13	13	U	13
Aroclor-1260	14	U	14	15		14	13	U	13	13	U	13	13	U	13	13	U	13
Semivolatile Organics																		
1,2,4-Trichlorobenzene	680	U	680	350	U	350	1700	U	1700	340	U	340	330	U	330	1700	U	1700
1,2-Dichlorobenzene	680	U	680	350	U	350	1700	U	1700	340	U	340	330	U	330	1700	U	1700
1,3-Dichlorobenzene	680	U	680	350	U	350	1700	U	1700	340	U	340	330	U	330	1700	U	1700
1,4-Dichlorobenzene	680	U	680	350	U	350	1700	U	1700	340	U	340	330	U	330	1700	U	1700
2,4,5-Trichlorophenol	1700	U	1700	870	U	870	4200	U	4200	860	U	860	840	U	840	4200	U	4200
2,4,6-Trichlorophenol	680	U	680	350	U	350	1700	U	1700	340	U	340	330	U	330	1700	U	1700
2,4-Dichlorophenol	680	U	680	350	U	350	1700	U	1700	340	U	340	330	U	330	1700	U	1700
2,4-Dimethylphenol	680	U	680	350	U	350	1700	U	1700	340	U	340	330	U	330	1700	U	1700
2,4-Dinitrophenol	1700	U	1700	870	U	870	4200	U	4200	860	U	860	840	U	840	4200	U	4200
2,4-Dinitrotoluene	680	U	680	350	U	350	1700	U	1700	340	U	340	330	U	330	1700	U	1700
2,6-Dinitrotoluene	680	U	680	350	U	350	1700	U	1700	340	U	340	330	U	330	1700	U	1700
2-Chloronaphthalene	680	U	680	350	U	350	1700	U	1700	340	U	340	330	U	330	1700	U	1700
2-Chlorophenol	680	U	680	350	U	350	1700	U	1700	340	U	340	330	U	330	1700	U	1700
2-Methylnaphthalene	680	U	680	350	U	350	1700	U	1700	340	U	340	330	U	330	1700	U	1700
2-Methylphenol (cresol, o-)	680	U	680	350	U	350	1700	U	1700	340	U	340	330	U	330	1700	U	1700
2-Nitroaniline	1700	U	1700	870	U	870	4200	U	4200	860	U	860	840	U	840	4200	U	4200
2-Nitrophenol	680	U	680	350	U	350	1700	U	1700	340	U	340	330	U	330	1700	U	1700
3,3'-Dichlorobenzidine	680	U	680	350	U	350	1700	U	1700	340	U	340	330	U	330	1700	U	1700
3-Nitroaniline	1700	U	1700	870	U	870	4200	U	4200	860	U	860	840	U	840	4200	U	4200
4,6-Dinitro-2-methylphenol	1700	U	1700	870	U	870	4200	U	4200	860	U	860	840	U	840	4200	U	4200
4-Bromophenylphenyl ether	680	U	680	350	U	350	1700	U	1700	340	U	340	330	U	330	1700	U	1700
4-Chloro-3-methylphenol	680	U	680	350	U	350	1700	U	1700	340	U	340	330	U	330	1700	U	1700

Table A-1. Confirmatory Sampling Results 100-C-9:1 North and South (6 pages)

Constituent	J00YP2 Sample Area B1 Sample Date 9/30/03			J00YP3 Sample Area B3 Sample Date 10/13/03			J00YP7 Sample Area B2 Sample Date 9/30/03			J00YP8 Sample Area B4 Sample Date 10/17/03			J00YP9 Duplicate of B2 Sample Date 9/30/03			J00YR0 Equipment Blank Sample Date 9/30/03		
	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL
4-Chloroaniline	680	U	680	350	U	350	1700	U	1700	340	U	340	330	U	330	1700	U	1700
4-Chlorophenylphenyl ether	680	U	680	350	U	350	1700	U	1700	340	U	340	330	U	330	1700	U	1700
4-Methylphenol (cresol, p-)	680	U	680	350	U	350	1700	U	1700	340	U	340	330	U	330	1700	U	1700
4-Nitroaniline	1700	U	1700	870	U	870	4200	U	4200	860	U	860	840	U	840	4200	U	4200
4-Nitrophenol	1700	U	1700	870	U	870	4200	U	4200	860	U	860	840	U	840	4200	U	4200
Acenaphthene	680	U	680	350	U	350	1700	U	1700	340	U	340	330	U	330	1700	U	1700
Acenaphthylene	680	U	680	350	U	350	1700	U	1700	340	U	340	330	U	330	1700	U	1700
Anthracene	680	U	680	350	U	350	1700	U	1700	340	U	340	330	U	330	1700	U	1700
Benzo(a)anthracene	680	U	680	35	J	350	1700	U	1700	340	U	340	330	U	330	1700	U	1700
Benzo(a)pyrene	680	U	680	34	J	350	1700	U	1700	340	U	340	330	U	330	1700	U	1700
Benzo(b)fluoranthene	680	U	680	31	J	350	1700	U	1700	340	U	340	330	U	330	1700	U	1700
Benzo(ghi)perylene	680	U	680	21	J	350	1700	U	1700	340	U	340	330	U	330	1700	U	1700
Benzo(k)fluoranthene	680	U	680	30	J	350	1700	U	1700	340	U	340	330	U	330	1700	U	1700
Bis(2-chloro-1-methylethyl)ether	680	U	680	350	U	350	1700	U	1700	340	U	340	330	U	330	1700	U	1700
Bis(2-Chloroethoxy)methane	680	U	680	350	U	350	1700	U	1700	340	U	340	330	U	330	1700	U	1700
Bis(2-chloroethyl) ether	680	U	680	350	U	350	1700	U	1700	340	U	340	330	U	330	1700	U	1700
Bis(2-ethylhexyl) phthalate	680	U	680	77	J	350	1700	U	1700	41	J N	340	33	C	330	1700	U	1700
Butylbenzylphthalate	680	U	680	350	U	350	1700	U	1700	340	U	340	330	U	330	1700	U	1700
Carbazole	680	U	680	350	U	350	1700	U	1700	340	U	340	330	U	330	1700	U	1700
Chrysene	680	U	680	36	J	350	1700	U	1700	340	U	340	330	U	330	1700	U	1700
Di-n-butylphthalate	36	J	680	250	J	350	1700	U	1700	200	JB	340	330	U	330	1700	U	1700
Di-n-octylphthalate	680	U	680	350	U	350	1700	U	1700	340	U	340	330	U	330	1700	U	1700
Dibenz[a,h]anthracene	680	U	680	350	U	350	1700	U	1700	340	U	340	330	U	330	1700	U	1700
Dibenzofuran	680	U	680	350	U	350	1700	U	1700	340	U	340	330	U	330	1700	U	1700
Diethylphthalate	680	U	680	350	U	350	1700	U	1700	340	U	340	330	U	330	1700	U	1700
Dimethyl phthalate	680	U	680	350	U	350	1700	U	1700	340	U	340	330	U	330	1700	U	1700
Fluoranthene	39	J	680	51	J	350	1700	U	1700	340	U	340	330	U	330	1700	U	1700
Fluorene	680	U	680	350	U	350	1700	U	1700	340	U	340	330	U	330	1700	U	1700
Hexachlorobenzene	680	U	680	350	U	350	1700	U	1700	340	U	340	330	U	330	1700	U	1700
Hexachlorobutadiene	680	U	680	350	U	350	1700	U	1700	340	U	340	330	U	330	1700	U	1700

Table A-1. Confirmatory Sampling Results 100-C-9:1 North and South (6 pages)

Constituent	J00YP2 Sample Area B1 Sample Date 9/30/03			J00YP3 Sample Area B3 Sample Date 10/13/03			J00YP7 Sample Area B2 Sample Date 9/30/03			J00YP8 Sample Area B4 Sample Date 10/17/03			J00YP9 Duplicate of B2 Sample Date 9/30/03			J00YR0 Equipment Blank Sample Date 9/30/03		
	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL
Hexachlorocyclopentadiene	680	U	680	350	U	350	1700	U	1700	340	U	340	330	U	330	1700	U	1700
Hexachloroethane	680	U	680	350	U	350	1700	U	1700	340	U	340	330	U	330	1700	U	1700
Indeno(1,2,3-cd)pyrene	680	U	680	350	U	350	1700	U	1700	340	U	340	330	U	330	1700	U	1700
Isophorone	680	U	680	350	U	350	1700	U	1700	340	U	340	330	U	330	1700	U	1700
N-Nitroso-di-n-dipropylamine	680	U	680	350	U	350	1700	U	1700	340	U	340	330	U	330	1700	U	1700
N-Nitrosodiphenylamine	680	U	680	350	U	350	1700	U	1700	340	U	340	330	U	330	1700	U	1700
Naphthalene	680	U	680	350	U	350	1700	U	1700	340	U	340	330	U	330	1700	U	1700
Nitrobenzene	680	U	680	350	U	350	1700	U	1700	340	U	340	330	U	330	1700	U	1700
Pentachlorophenol	1700	U	1700	870	U	870	4200	U	4200	860	U	860	840	U	840	4200	U	4200
Phenanthrene	680	U	680	22	J	350	1700	U	1700	340	U	340	330	U	330	1700	U	1700
Phenol	680	U	680	350	U	350	1700	U	1700	340	U	340	330	U	330	1700	U	1700
Pyrene	680	U	680	39	J	350	1700	U	1700	340	U	340	330	U	330	1700	U	1700

Table A-2. Cold Joint Soil Sampling Results Northern 100-C-9:1

HEIS #	Northing	Easting	Sample Date	Barium			Silver			Arsenic			Cadmium			Chromium		
				mg/kg	Q	MDL	mg/kg	Q	MDL	mg/kg	Q	MDL	mg/kg	Q	MDL	mg/kg	Q	MDL
J02335	145417.74	565735.97	12/02/04	49.6		0.04	0.1	U	0.1	2.5		0.25	0.03	U	0.03	11.4		0.08
J02336	145338.63	565737.16	12/02/04	161		0.04	0.09	U	0.09	2.7		0.24	0.03	U	0.03	17.3		0.07
J02328	145220.38	565726.1	11/24/04	68.3		0.04	0.1	U	0.1	3.2		0.27	0.03	U	0.03	10.4		0.08
J02337	145001.64	565665.57	12/08/04	50		0.03	0.06	U	0.06	2.4		0.17	0.34		0.02	6.3		0.05
J02346	144884.5	565632.42	12/14/04	70.8		0.04	0.1	U	0.1	3		0.26	0.27		0.03	14.1		0.08

HEIS #	Northing	Easting	Sample Date	Mercury			Selenium			Lead		
				mg/kg	Q	MDL	mg/kg	Q	MDL	mg/kg	Q	MDL
J02335	145417.74	565735.97	12/02/04	0.02	U	0.02	0.36	U	0.36	2.8		0.22
J02336	145338.63	565737.16	12/02/04	0.01	U	0.01	0.35	U	0.35	3.5		0.21
J02328	145220.38	565726.1	11/24/04	0.02	U	0.02	0.38	U	0.38	4.1		0.23
J02337	145001.64	565665.57	12/08/04	0.02	U	0.02	0.43		0.24	2.9		0.14
J02346	144884.5	565632.42	12/14/04	0.02	U	0.02	0.36	U	0.36	4.9		0.22

HEIS #	Northing	Easting	Sample Date	TCLP Barium			TCLP Silver			TCLP Arsenic			TCLP Cadmium			TCLP Chromium		
				mg/L	Q	MDL	mg/L	Q	MDL	mg/L	Q	MDL	mg/L	Q	MDL	mg/L	Q	MDL
J02335	145417.74	565735.97	12/02/04	0.284		0.002	0.006	U	0.006	0.019		0.0156	0.0018	U	0.0018	0.0048	U	0.0048
J02336	145338.63	565737.16	12/02/04	0.287		0.002	0.006	U	0.006	0.0156	U	0.0156	0.0018	U	0.0018	0.0064		0.0048
J02328	145220.38	565726.1	11/24/04	0.154		0.002	0.0051	U	0.0051	0.0181	U	0.0181	0.0035	U	0.0035	0.0088	U	0.0088

HEIS #	Northing	Easting	Sample Date	TCLP Selenium			TCLP lead			TCLP Mercury			Hexavalent Chromium		
				mg/L	Q	MDL	mg/L	Q	MDL	mg/L	Q	MDL	mg/L	Q	MDL
J02335	145417.74	565735.97	12/02/04	0.023	U	0.023	0.013	U	0.013	0.0001	U	0.0001			
J02336	145338.63	565737.16	12/02/04	0.022	U	0.022	0.0154		0.0132	0.0001	U	0.0001			
J02328	145220.38	565726.1	11/24/04	0.048	U	0.048	0.033	U	0.033	0.0001	U	0.0001			
J022X1	145417.74	565735.97	12/02/04										0.2358	U	0.35
J022X2	145338.63	565737.16	12/02/04										0.1136	U	0.1136
J022W8	145220.38	565726.1	11/24/04										0.396		0.35
J022W9	145001.64	565665.57	12/08/04										0.084	U	0.084
J022X0	144884.5	565632.42	12/14/04										0.229	U	0.229

Table A-3. Shallow/Deep Zone Sampling Results at the South End of the Northern 100-C-9:1 Excavation (2 pages)

Sample media	HEIS Number	Sample Date	Americium-241 GEA			Cesium-137			Cobalt-60			Europium-152			Europium-154			Europium-155		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
soil	J030C5	3/29/05	0.19	U	0.19	0.148		0.091	0.096	U	0.096	0.2	U	0.2	0.29	U	0.29	0.21	U	0.21
soil	J030C6	3/29/05	0.076	U	0.076	0.092	U	0.092	0.094	U	0.094	0.26	U	0.26	0.31	U	0.31	0.15	U	0.15
pipe scale	J030C7	3/29/05	0.089	U	0.089	1.25		0.042	0.037	U	0.037	0.135		0.096	0.11	U	0.11	0.091	U	0.091
pipe scale	J030C8	3/29/05	0.11	U	0.11	0.183		0.056	0.052	U	0.052	0.12	U	0.12	0.16	U	0.16	0.11	U	0.11

Sample Area	HEIS Number	Sample Date	Potassium-40			Radium-226			Radium-228			Thorium-228 GEA		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
soil	J030C5	3/29/05	7.98		1.2	0.354		0.15	0.576		0.34	0.321		0.14
soil	J030C6	3/29/05	6.35		0.78	0.218		0.13	0.39	U	0.39	0.493		0.097
pipe scale	J030C7	3/29/05	7.83		0.38	0.565		0.068	0.29		0.16	0.299		0.039
pipe scale	J030C8	3/29/05	7.38		0.4	0.544		0.1	0.38		0.26	0.323		0.048

Sample Area	HEIS Number	Sample Date	Thorium-232 GEA			Uranium-235 GEA			Uranium-238 GEA		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
soil	J030C5	3/29/05	0.576		0.34	0.28	U	0.28	8.8	U	8.8
soil	J030C6	3/29/05	0.39	U	0.39	0.25	U	0.25	11	U	11
pipe scale	J030C7	3/29/05	0.29		0.16	0.13	U	0.13	4	U	4
pipe scale	J030C8	3/29/05	0.38		0.26	0.17	U	0.17	5.4	U	5.4

Table A-3. Shallow/Deep Zone Sampling Results at the South End of the Northern 100-C-9:1 Excavation (2 pages)

Sample Location (relative to the twin box culvert)	Sample Number	Sample Date	Aluminum			Antimony			Arsenic			Barium			Beryllium			Boron		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
soil	J030C5	3/29/05	3620		2	0.43	C	0.5	2.7	C	0.5	41.6	C	0.02	1.3	C	0.01	1.1	C	0.2
soil	J030C6	3/29/05	3880		2	0.3	C	0.5	2.4	C	0.5	46	C	0.02	1.8	C	0.01	1	C	0.2
pipe scale	J030C7	3/29/05							52.3		0.5	139		0.02						
pipe scale	J030C8	3/29/05							69.4		0.5	120		0.02						

Sample Location (relative to the twin box culvert)	Sample Number	Sample Date	Cadmium			Calcium			Chromium			Cobalt			Copper			Hexavalent Chromium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
soil	J030C5	3/29/05	0.06		0.05	7250	C	5	16.1	C	0.1	7.6	C	0.1	24.7	C	0.1	1.3		0.5
soil	J030C6	3/29/05	0.04	U	0.04	7070	C	5	8.6	C	0.1	9.1	C	0.1	37.3	C	0.1	1.7		0.5
pipe scale	J030C7	3/29/05	6.1		0.05				194		0.1									
pipe scale	J030C8	3/29/05	4		0.05				236		0.1									
pipe scale	J030C9	3/29/05																48.1		0.5
pipe scale	J030D0	3/29/05																50.1		0.5

Sample Location (relative to the twin box culvert)	Sample Number	Sample Date	Iron			Lead			Lithium			Magnesium			Manganese			Mercury		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
soil	J030C5	3/29/05	21200			7.5	C	0.5	2.9	C	0.01	3090	C	5	299	C	0.02	2.6		0.02
soil	J030C6	3/29/05	26900			15.3	C	0.5	3.4	C	0.01	4010	C	5	311	C	0.02	2.6		0.02
pipe scale	J030C7	3/29/05				9.3		0.5												
pipe scale	J030C8	3/29/05				7.4		0.5												

Sample Location (relative to the twin box culvert)	Sample Number	Sample Date	Molybdenum			Nickel			Phosphorus			Potassium			Selenium			Silicon		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
soil	J030C5	3/29/05	0.57	C	0.3	6.3	C	0.2	1230	C	2	730	C	50	0.39	UC	0.39	461	C	1
soil	J030C6	3/29/05	0.62	C	0.3	6.8	C	0.2	1370	C	2	788	C	50	0.42	UC	0.42	327	C	1
pipe scale	J030C7	3/29/05													0.405	U	0.405			
pipe scale	J030C8	3/29/05													0.373	U	0.373			

Table A-3. Shallow/Deep Zone Sampling Results at the South End of the Northern 100-C-9:1 Excavation (2 pages)

Sample Location (relative to the twin box culvert)	Sample Number	Sample Date	Silver			Sodium			Strontium			Thallium			Tin			Titanium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
soil	J030C5	3/29/05	0.05	UC	0.05	377	C	3	18	C	0.01	0.63	U	0.63	1.9	C	0.6	1640	C	0.02
soil	J030C6	3/29/05	0.05	UC	0.05	368	C	3	18.2	C	0.01	0.68	U	0.68	4.5	C	0.6	2300	C	0.02
pipe scale	J030C7	3/29/05	0.051	U	0.051															
pipe scale	J030C8	3/29/05	0.047	U	0.047															

Sample Location (relative to the twin box culvert)	Sample Number	Sample Date	Uranium			Vanadium			Zinc			Zirconium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
soil	J030C5	3/29/05	0.78	U	0.78	46.6	C	0.1	40.8	C	0.1	17		1
soil	J030C6	3/29/05	0.84	U	0.84	66.3	C	0.1	47.6	C	0.1	24.2		1
pipe scale	J030C8	3/29/05	0.047	U	0.047									

Table A-4. Cold Joint Soil Sampling Results Southern 100-C-9:1 (4 pages).

Sample Location	Media	HEIS Number	Sample Date	Aluminum		Antimony		Arsenic		Barium		Beryllium		Boron		Cadmium	
				mg/kg	Q	mg/kg	Q	mg/kg	Q	mg/kg	Q	mg/kg	Q	mg/kg	Q	mg/kg	Q
1st Cold Joint	Soil	J02349	01/27/05	4570		0.23		3.4		40.1		0.62		0.88		0.23	
2nd Cold Joint	Soil	J02350	01/28/05	6040		0.23	U	2.9		50.7		0.65		0.89		0.27	
Cold Joint (East joint/north side)	Soil	J03261	04/19/05	5740		0.191	U	2.9		50.3	C	0.448		1.1	C	0.09	
Cold Joint (East joint/south side)	Soil	J03262	04/19/05	6740		1.5		7		58.4	C	0.504		1.5	C	0.237	
Cold Joint (East joint/south side)	Scale	J03269	05/04/05					42		97.6						1.4	
Cold Joint (East joint/north side)	Scale	J03270	05/04/05					45.4		134						3	
Cold Joint (Center joint/east side)	Soil	J03257	04/19/05	4070		0.233	U	2.7		30.4	C	0.408		0.855	C	0.151	
Cold Joint (Center joint/west side)	Soil	J03258	04/19/05	5330		0.963		5.9		50	C	0.405		1.2	C	0.147	
Cold Joint (Center joint/east side)	Scale	J03271	05/04/05					9.2		117						1	
Cold Joint (West joint/south side)	Soil	J03259	04/19/05	8790		0.276		6.4		79.1	C	0.575		1.2	C	0.322	
Cold Joint (West joint/north side)	Soil	J03260	04/19/05	6590		0.244	U	5.2		64	C	0.537		1.1	C	0.155	
Cold Joint (West joint/north side)	Scale	J03272	05/04/05					8.6		125						2.2	
Cold Joint (West joint/south side)	Scale	J03273	05/04/05					9		125						1.7	

Sample Location	Media	HEIS Number	Sample Date	Calcium		Chromium		Cobalt		Copper		Hexavalent Chromium		Iron		Lead	
				mg/kg	Q	mg/kg	Q	mg/kg	Q	mg/kg	Q	mg/kg	Q	mg/kg	Q	mg/kg	Q
1st Cold Joint	Soil	J02349	01/27/05	6180		5.6		7.5		14.1				20100		3.3	
1st Cold Joint	Soil	J022X3	01/27/05	5360		8.3		8		14.7		0.35	U	22500		4.3	
2nd Cold Joint	Soil	J02350	01/28/05														
2nd Cold Joint	Soil	J022X4	01/28/05									0.35	U				
Cold Joint (East joint/north side)	Soil	J03261	04/19/05	6030		9.9	C	8.9		28.8		0.353		23600	C	5.1	
Cold Joint (East joint/south side)	Soil	J03262	04/19/05	12100		80.8	C	10.6		91.4		1.22		27900	C	49.9	
Cold Joint (East joint/south side)	Scale	J03263	05/04/05									159					
Cold Joint (East joint/south side)	Scale	J03269	05/04/05			250										5.9	
Cold Joint (East joint/north side)	Scale	J03264	05/04/05									87					
Cold Joint (East joint/north side)	Scale	J03270	05/04/05			663										10.7	
Cold Joint (Center joint/east side)	Soil	J03257	04/19/05	5760		6.3	C	8.5		35.3		0.214	U	22100	C	3.1	
Cold Joint (Center joint/west side)	Soil	J03258	04/19/05	10700		26.8	C	8.8		53.7		1.56		23100	C	8.8	
Cold Joint (Center joint/east side)	Scale	J03265	05/04/05									149					
Cold Joint (Center joint/east side)	Scale	J03271	05/04/05			380										5	
Cold Joint (West joint/south side)	Soil	J03259	04/19/05	23900		11.3	C	9.4		34.2		0.327		24100	C	9.7	
Cold Joint (West joint/north side)	Soil	J03260	04/19/05	12600		10	C	9.1		25.5		0.282		25900	C	7.3	
Cold Joint (West joint/north side)	Scale	J03266	05/04/05									152					
Cold Joint (West joint/north side)	Scale	J03267	05/04/05									37.6					
Cold Joint (West joint/north side)	Scale	J03272	05/04/05			624										6.9	
Cold Joint (West joint/south side)	Scale	J03273	05/04/05			172										5.1	

Table A-4. Cold Joint Soil Sampling Results Southern 100-C-9:1 (4 pages).

Sample Location	Media	HEIS Number	Sample Date	Lithium		Magnesium		Manganese		Mercury		Molybdenum		Nickel		Phosphorus	
				mg/kg	Q	mg/kg	Q	mg/kg	Q	mg/kg	Q	mg/kg	Q	mg/kg	Q	mg/kg	Q
1st Cold Joint	Soil	J02349	01/27/05	5.1		4010		275		0.03		0.33		7.6		921	
2nd Cold Joint	Soil	J02350	01/28/05	6.5		4360		336		0.02	U	0.31		10.4		1000	
Cold Joint (East joint/north side)	Soil	J03261	04/19/05	5.7	C	4190	C	325		0.417		0.613		9.4		1120	
Cold Joint (East joint/south side)	Soil	J03262	04/19/05	6.8	C	4990	C	370		11.6		0.719		10.7		1310	
Cold Joint (Center joint/east side)	Soil	J03257	04/19/05	4.2	C	3710	C	294		0.549		0.584		8.7		1260	
Cold Joint (Center joint/west side)	Soil	J03258	04/19/05	5.2	C	3790	C	320		0.458		0.658		8.7		1190	
Cold Joint (West joint/south side)	Soil	J03259	04/19/05	12.2	C	6580	C	398		2.84		0.706		13.2		916	
Cold Joint (West joint/north side)	Soil	J03260	04/19/05	8.9	C	5680	C	377		4.03		0.723		10.9		1060	
Cold Joint (East joint/south side)	Scale	J03269	05/04/05							2.2							
Cold Joint (East joint/north side)	Scale	J03270	05/04/05							1.9							
Cold Joint (Center joint/east side)	Scale	J03271	05/04/05							6.4							
Cold Joint (West joint/north side)	Scale	J03272	05/04/05							1.4							
Cold Joint (West joint/south side)	Scale	J03273	05/04/05							1.9							

Sample Location	Media	HEIS Number	Sample Date	Potassium		Selenium		Silicon		Silver		Sodium		Strontium		Thallium	
				mg/kg	Q	mg/kg	Q	mg/kg	Q	mg/kg	Q	mg/kg	Q	mg/kg	Q	mg/kg	Q
1st Cold Joint	Soil	J02349	01/27/05	913		0.39	U	264		0.05	U	269		20		0.64	U
2nd Cold Joint	Soil	J02350	01/28/05	1230		0.41	U	185		0.05	U	286		20.8		0.67	U
Cold Joint (East joint/north side)	Soil	J03261	04/19/05	1140		0.348	U	145		0.043	U	247	C	21.6	C	0.565	U
Cold Joint (East joint/south side)	Soil	J03262	04/19/05	1380		0.376	U	682		0.047	U	449	C	32.6	C	0.61	U
Cold Joint (East joint/south side)	Scale	J03269	05/04/05			0.43	U			0.08	U						
Cold Joint (East joint/north side)	Scale	J03270	05/04/05			0.43	U			0.08	U						
Cold Joint (Center joint/east side)	Soil	J03257	04/19/05	915		0.424	U	198		0.053	U	387	C	16	C	0.688	U
Cold Joint (Center joint/west side)	Soil	J03258	04/19/05	1110		0.357	U	182		0.045	U	563	C	23.3	C	0.58	
Cold Joint (Center joint/east side)	Scale	J03271	05/04/05			0.41	U			0.08	U						
Cold Joint (West joint/south side)	Soil	J03259	04/19/05	1710		0.383	U	217		0.048	U	323	C	38.5	C	0.623	U
Cold Joint (West joint/north side)	Soil	J03260	04/19/05	1330		0.444	U	304		0.271		302	C	26.9	C	0.722	U
Cold Joint (West joint/north side)	Scale	J03272	05/04/05			0.5	U			0.09	U						
Cold Joint (West joint/south side)	Scale	J03273	05/04/05			0.5	U			0.09	U						

Table A-4. Cold Joint Soil Sampling Results Southern 100-C-9:1 (4 pages).

Sample Location	Media	HEIS Number	Sample Date	Tin		Titanium		Uranium		Vanadium		Zinc		Zirconium	
				mg/kg	Q	mg/kg	Q	mg/kg	Q	mg/kg	Q	mg/kg	Q	mg/kg	Q
1st Cold Joint	Soil	J02349	01/27/05	1.3		1620		0.80	U	44.9		37.5		18.0	
2nd Cold Joint	Soil	J02350	01/28/05	0.69		1580		0.84	U	50.4		41.9		18.1	
Cold Joint (East joint/north side)	Soil	J03261	04/19/05	1.4	C	1960		0.704	U	59.4		50	C	21.3	
Cold Joint (East joint/south side)	Soil	J03262	04/19/05	39.3	C	1960		0.761	U	64.3		68.1	C	17.3	
Cold Joint (Center joint/east side)	Soil	J03257	04/19/05	2	C	1810		0.858	U	53.1		38.9	C	19.9	
Cold Joint (Center joint/west side)	Soil	J03258	04/19/05	2.9	C	1710		0.723	U	54.1		62.4	C	19.1	
Cold Joint (West joint/south side)	Soil	J03259	04/19/05	0.908	C	1420		0.776	U	46.5		58	C	15.7	
Cold Joint (West joint/north side)	Soil	J03260	04/19/05	1.5	C	2030		0.899	U	61.2		51.3	C	20.8	

Table A-4. Cold Joint Soil Sampling Results Southern 100-C-9:1 (4 pages).

Sample Location	Media	HEIS Number	Sample Date	Americium-241			Cesium-137			Cobalt-60			Europium-152			Europium-154		
				pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
Cold Joint (East joint/north side)	Soil	J03261	04/19/05	0.14	U	0.14	0.035	U	0.035	0.035	U	0.035	0.081	U	0.081	0.11	U	0.11
Cold Joint (East joint/south side)	Soil	J03262	04/19/05	0.11	U	0.11	0.028	U	0.028	0.028	U	0.028	0.067	U	0.067	0.086	U	0.086
Cold Joint (East joint/south side)	Scale	J03269	05/04/05	0.29	U	0.29	0.08	U	0.08	0.066	U	0.066	0.27	U	0.27	0.26	U	0.26
Cold Joint (East joint/north side)	Scale	J03270	05/04/05	0.19	U	0.19	0.1	U	0.1	0.095	U	0.095	0.2	U	0.2	0.27	U	0.27
Cold Joint (Center joint/east side)	Soil	J03257	04/19/05	0.086	U	0.086	0.035	U	0.035	0.037	U	0.037	0.088	U	0.088	0.12	U	0.12
Cold Joint (Center joint/west side)	Soil	J03258	04/19/05	0.076	U	0.076	0.031	U	0.031	0.034	U	0.034	0.079	U	0.079	0.099	U	0.099
Cold Joint (Center joint/east side)	Scale	J03271	05/04/05	0.21	U	0.21	0.091	U	0.091	0.11	U	0.11	0.21	U	0.21	0.22	U	0.22
Cold Joint (West joint/south side)	Soil	J03259	04/19/05	0.16	U	0.16	0.062	U	0.062	0.065	U	0.065	0.16	U	0.16	0.2	U	0.2
Cold Joint (West joint/north side)	Soil	J03260	04/19/05	0.17	U	0.17	0.041	U	0.041	0.045	U	0.045	0.1	U	0.1	0.14	U	0.14
Cold Joint (West joint/north side)	Scale	J03272	05/04/05	0.26	U	0.26	0.077	U	0.077	0.073	U	0.073	0.15	U	0.15	0.22	U	0.22
Cold Joint (West joint/south side)	Scale	J03273	05/04/05	0.42	U	0.42	0.072	U	0.072	0.079	U	0.079	0.16	U	0.16	0.26	U	0.26

Sample Location	Media	HEIS Number	Sample Date	Europium-155			Potassium-40			Radium-226			Radium-228			Thorium-232		
				pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
Cold Joint (East joint/north side)	Soil	J03261	04/19/05	0.089	U	0.089	10.4		0.29	0.389		0.073	0.636		0.14	0.565		0.064
Cold Joint (East joint/south side)	Soil	J03262	04/19/05	0.071	U	0.071	8.98		0.29	0.383		0.052	0.499		0.13	0.458		0.029
Cold Joint (East joint/south side)	Scale	J03269	05/04/05	0.18	U	0.18	6.36		0.94	0.411		0.15	0.44	U	0.44	0.337		0.076
Cold Joint (East joint/north side)	Scale	J03270	05/04/05	0.18	U	0.18	7.77		0.71	0.314		0.18	0.75	U	0.75	0.406		0.13
Cold Joint (Center joint/east side)	Soil	J03257	04/19/05	0.079	U	0.079	8.04		0.46	0.356		0.061	0.492		0.15	0.44		0.034
Cold Joint (Center joint/west side)	Soil	J03258	04/19/05	0.073	U	0.073	8		0.34	0.298		0.07	0.514		0.14	0.364		0.032
Cold Joint (Center joint/east side)	Scale	J03271	05/04/05	0.2	U	0.2	8.08		0.93	0.372		0.18	0.62	U	0.62	0.354		0.086
Cold Joint (West joint/south side)	Soil	J03259	04/19/05	0.14	U	0.14	14.6		0.51	0.519		0.12	0.693		0.31	0.726		0.064
Cold Joint (West joint/north side)	Soil	J03260	04/19/05	0.11	U	0.11	13		0.48	0.416		0.09	0.765		0.17	0.65		0.048
Cold Joint (West joint/north side)	Scale	J03272	05/04/05	0.18	U	0.18	7.89		0.55	0.264		0.14	0.7	U	0.7	0.239		0.13
Cold Joint (West joint/south side)	Scale	J03273	05/04/05	0.16	U	0.16	7.37		0.72	0.384		0.14	0.61	U	0.61	0.317		0.076

Sample Location	Media	HEIS Number	Sample Date	Thorium-232			Uranium-235			Uranium-238		
				pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
Cold Joint (East joint/north side)	Soil	J03261	04/19/05	0.636		0.14	0.13	U	0.13	4.6	U	4.6
Cold Joint (East joint/south side)	Soil	J03262	04/19/05	0.499		0.13	0.1	U	0.1	3.4	U	3.4
Cold Joint (East joint/south side)	Scale	J03269	05/04/05	0.44	U	0.44	0.26	U	0.26	9.1	U	9.1
Cold Joint (East joint/north side)	Scale	J03270	05/04/05	0.75	U	0.75	0.29	U	0.29	11	U	11
Cold Joint (Center joint/east side)	Soil	J03257	04/19/05	0.492		0.15	0.12	U	0.12	4.4	U	4.4
Cold Joint (Center joint/west side)	Soil	J03258	04/19/05	0.514		0.14	0.11	U	0.11	3.9	U	3.9
Cold Joint (Center joint/east side)	Scale	J03271	05/04/05	0.62	U	0.62	0.29	U	0.29	11	U	11
Cold Joint (West joint/south side)	Soil	J03259	04/19/05	0.693		0.31	0.21	U	0.21	7.9	U	7.9
Cold Joint (West joint/north side)	Soil	J03260	04/19/05	0.765		0.17	0.15	U	0.15	5.3	U	5.3
Cold Joint (West joint/north side)	Scale	J03272	05/04/05	0.7	U	0.7	0.23	U	0.23	9	U	9
Cold Joint (West joint/south side)	Scale	J03273	05/04/05	0.61	U	0.61	0.25	U	0.25	10	U	10

Table A-5. Stockpile Sample Results Southern 100-C-9:1 (11 pages).

Stockpile Number	Stockpile Description	Media	HEIS Number	Date	Aluminum		Antimony		Arsenic		Barium		Beryllium	
					mg/kg	Q	mg/kg	Q	mg/kg	Q	mg/kg	Q	mg/kg	Q
4FF	Overburden - 1st lift	Soil	J02720	01/12/05	5550		0.31		3.2	C	56.9	C	0.72	
4FF	Overburden - 1st lift	Soil	J02721	01/12/05					3.3	C	52.4	C		
4FF	Overburden - 1st lift	Soil	J02722	01/12/05					3.2	C	52.5	C		
4FF	Overburden - 1st lift	Soil	J02723	01/12/05					2.7	C	49.7	C		
4FF	Overburden - 1st lift	Soil	J02724	01/12/05					3.4	C	53.9	C		
4FF	Overburden - 1st lift	Soil	J02725	01/12/05					3.1	C	49.8	C		
4FF	Overburden - 2nd lift	Soil	J02FY7	02/01/05	5630	C	0.22	U	3.1		52.9	C	1.1	
4FF	Overburden - 2nd lift	Soil	J02FY8	02/01/05	4680	C	0.21	U	1.2		48.5	C	0.38	
4FF	Overburden - 2nd lift	Soil	J02H03	02/01/05					2.9		62.4	C		
4FF	Overburden - 2nd lift	Soil	J02FY6	02/01/05	4850	C	0.23	U	2.4		52.9	C	0.42	
4FF	Overburden - 2nd lift	Soil	J02FY9	02/01/05	4430	C	0.18	U	1.2		47.9	C	0.33	
4FF	Overburden - 2nd lift	Soil	J02H00	02/01/05	4860	C	0.2	U	1.8		50.6	C	0.39	
4FF	Overburden - 2nd lift	Soil	J02H02	02/01/05	4440	C	0.22	U	2.2		45	C	0.38	
4FF	Overburden - 2nd lift	Soil	J02H01	02/01/05	4020	C	0.16	U	2		45.2	C	0.31	
3FF	Overburden	Soil	J02FL1	01/25/05	6110		0.63		4.2		52	C	1	
3FF	Overburden	Soil	J02FL2	01/25/05	5450		1.4		2.6		46.2	C	0.93	
3FF	Overburden	Soil	J02FL3	01/25/05	6560		0.27	U	2.7		54.4	C	1	
3FF	Overburden	Soil	J02FL4	01/25/05	5220		0.29	U	2.8		51.3	C	0.87	
3FF	Overburden	Soil	J02FL5	01/25/05	5860		0.31		2.9		53.8	C	1	
3FF	Overburden	Soil	J02FL6	01/25/05	5580		0.28	U	2.5		49	C	0.93	
5FF	Suspect BCL - 16" spur	Soil	J02HJ2	02/11/05	7690		0.21	U	3.9		73	C	1.1	
5FF	Suspect BCL - 16" spur	Soil	J02HJ4	02/11/05	7510		0.36		3.7		69.2	C	1.1	
5FF	Suspect BCL - 16" spur	Soil	J02HJ5	02/11/05	7830		0.23		3.9		75.7	C	1	
5FF	Suspect BCL - 16" spur	Soil	J02HJ6	02/11/05	7360		0.27		3.7		69.2	C	1	
5FF	Suspect BCL - 16" spur	Soil	J02HJ7	02/11/05	6620		0.23	U	3.2		74.6	C	0.99	
5FF	Suspect BCL - 16" spur	Soil	J02HJ8	02/11/05	6990		0.21	U	3.8		71.4	C	0.95	
2FF	Suspect BCL - 18" spur	Soil	J02H56	02/16/05	6930	C	0.19	U	3.4		64.2	C	0.55	
2FF	Suspect BCL - 18" spur	Soil	J02J00	02/16/05	8370	C	0.88	B	3.4		78.1	C	0.38	B
2FF	Suspect BCL - 18" spur	Soil	J02H57	02/16/05	7030	C	0.22	U	3.1		65.8	C	0.57	
2FF	Suspect BCL - 18" spur	Soil	J02H58	02/16/05	7400	C	0.21	U	3.3		68.9	C	0.6	
2FF	Suspect BCL - 18" spur	Soil	J02H59	02/16/05	7470	C	0.2	U	3.2		74.9	C	0.61	
2FF	Suspect BCL - 18" spur	Soil	J02HY8	02/17/05	6650		0.22	U	3.6		67.1	C	0.76	
2FF	Suspect BCL - 18" spur	Soil	J02HY9	02/17/05	6650		0.21		3.2		56.4	C	0.7	
2FF	Suspect BCL - 18" spur	Soil	J02H60	02/17/05	6680		0.2	U	3		59.8	C	0.73	
1FF	Suspect BCL	Soil	J02HK4	04/04/05	6650	C	0.842		5.3		58.4	C	1.7	C
1FF	Suspect BCL	Soil	J02HJ9	04/05/05	42.7	C	0.214	U	0.362		1.1	C	0.021	C
1FF	Suspect BCL	Soil	J02HK0	04/05/05	6480	C	0.353		3.6		58.5	C	1.8	C
1FF	Suspect BCL	Soil	J02HK1	04/05/05	6000	C	0.446		3.5		54.9	C	1.5	C
1FF	Suspect BCL	Soil	J02HY7	04/05/05					3.6		81	C		
1FF	Suspect BCL	Soil	J02HK2	04/05/05	6100	C	0.508		3.7		54.2	C	1.5	C

Table A-5. Stockpile Sample Results Southern 100-C-9:1 (11 pages).

Stockpile Number	Stockpile Description	Media	HEIS Number	Date	Boron		Cadmium		Calcium		Chromium		Cobalt	
					mg/kg	Q	mg/kg	Q	mg/kg	Q	mg/kg	Q	mg/kg	Q
4FF	Overburden - 1st lift	Soil	J02720	01/12/05	1.1		0.03	U	5640	C	8.2		7.3	
4FF	Overburden - 1st lift	Soil	J02721	01/12/05			0.03	U			7.7			
4FF	Overburden - 1st lift	Soil	J02722	01/12/05			0.02	U			8			
4FF	Overburden - 1st lift	Soil	J02723	01/12/05			0.03	U			7.6			
4FF	Overburden - 1st lift	Soil	J02724	01/12/05			0.03	U			8.2			
4FF	Overburden - 1st lift	Soil	J02725	01/12/05			0.03	U			8.1			
4FF	Overburden - 2nd lift	Soil	J02FY7	02/01/05	1.4	C	0.04	U	6800	C	7.9	C	8	
4FF	Overburden - 2nd lift	Soil	J02FY8	02/01/05	0.35	C	0.09		6490	C	4.7	C	6.4	
4FF	Overburden - 2nd lift	Soil	J02H03	02/01/05			0.023	U			9.9			
4FF	Overburden - 2nd lift	Soil	J02FY6	02/01/05	0.56	C	0.1		6660	C	6.4	C	7	
4FF	Overburden - 2nd lift	Soil	J02FY9	02/01/05	0.16	C	0.1		6190	C	4.9	C	6.2	
4FF	Overburden - 2nd lift	Soil	J02H00	02/01/05	0.27	C	0.11		6330	C	5.9	C	6.3	
4FF	Overburden - 2nd lift	Soil	J02H02	02/01/05	0.55	C	0.07		6080	C	5.4	C	6	
4FF	Overburden - 2nd lift	Soil	J02H01	02/01/05	0.37	C	0.08		5820	C	5	C	5.7	
3FF	Overburden	Soil	J02FL1	01/25/05	1.7		0.22		7850	C	8.8		8	
3FF	Overburden	Soil	J02FL2	01/25/05	1.5		0.21		5340	C	7.5		7.2	
3FF	Overburden	Soil	J02FL3	01/25/05	1.5		0.26		6440	C	8.2		7.9	
3FF	Overburden	Soil	J02FL4	01/25/05	1.3		0.2		5530	C	7.6		7.3	
3FF	Overburden	Soil	J02FL5	01/25/05	1.4		0.17		6210	C	8.7		8.7	
3FF	Overburden	Soil	J02FL6	01/25/05	1.3		0.14		5570	C	7.5		7.4	
5FF	Suspect BCL - 16" spur	Soil	J02HJ2	02/11/05	1.3		0.07		6750	C	14.9	C	8.4	C
5FF	Suspect BCL - 16" spur	Soil	J02HJ4	02/11/05	1.4		0.11		6420	C	14.3	C	8.4	C
5FF	Suspect BCL - 16" spur	Soil	J02HJ5	02/11/05	1.3		0.08		6400	C	15.4	C	8.3	C
5FF	Suspect BCL - 16" spur	Soil	J02HJ6	02/11/05	1.3		0.1		6410	C	13.5	C	8.6	C
5FF	Suspect BCL - 16" spur	Soil	J02HJ7	02/11/05	1.3		0.09		5310	C	12	C	7.9	C
5FF	Suspect BCL - 16" spur	Soil	J02HJ8	02/11/05	1.2		0.08		6830	C	13.4	C	8.2	C
2FF	Suspect BCL - 18" spur	Soil	J02H56	02/16/05	1.4		0.05		7700	C	10.6	C	8	
2FF	Suspect BCL - 18" spur	Soil	J02J00	02/16/05	8.6	BC	0.023	U	7060	C	11.3		11.5	
2FF	Suspect BCL - 18" spur	Soil	J02H57	02/16/05	1.4		0.09		6390	C	11.4	C	8.1	
2FF	Suspect BCL - 18" spur	Soil	J02H58	02/16/05	1.5		0.06		6510	C	12.3	C	8.2	
2FF	Suspect BCL - 18" spur	Soil	J02H59	02/16/05	1.4		0.08		6630	C	13.3	C	8.2	
2FF	Suspect BCL - 18" spur	Soil	J02HY8	02/17/05	1.6		0.13		8090	C	10.5		7.5	
2FF	Suspect BCL - 18" spur	Soil	J02HY9	02/17/05	1.3		0.09		6040	C	9.9		7.7	
2FF	Suspect BCL - 18" spur	Soil	J02H60	02/17/05	1.3		0.07		6650	C	10.7		7.8	
1FF	Suspect BCL	Soil	J02HK4	04/04/05	1.7	C	0.088		9040	C	9.6	C	8.8	
1FF	Suspect BCL	Soil	J02HJ9	04/05/05	0.354	C	0.039	U	23.4	C	0.188	C	0.068	U
1FF	Suspect BCL	Soil	J02HK0	04/05/05	1.3	C	0.041		7220	C	9.3	C	8.8	
1FF	Suspect BCL	Soil	J02HK1	04/05/05	1.4	C	0.027	U	7260	C	8.4	C	8.4	
1FF	Suspect BCL	Soil	J02HY7	04/05/05			0.022	U			10			
1FF	Suspect BCL	Soil	J02HK2	04/05/05	1.1	C	0.032	U	7300	C	9	C	9	

Table A-5. Stockpile Sample Results Southern 100-C-9:1 (11 pages).

Stockpile Number	Stockpile Description	Media	HEIS Number	Date	Copper		Hexavalent Chromium		Iron		Lead		Lithium	
					mg/kg	Q	mg/kg	Q	mg/kg	Q	mg/kg	Q	mg/kg	Q
4FF	Overburden - 1st lift	Soil	J02720	01/12/05	15.3		0.22	U	20500		5.1		6.4	
4FF	Overburden - 1st lift	Soil	J02721	01/12/05			0.22	U			5			
4FF	Overburden - 1st lift	Soil	J02722	01/12/05			0.29				5			
4FF	Overburden - 1st lift	Soil	J02723	01/12/05			0.21	U			5.7			
4FF	Overburden - 1st lift	Soil	J02724	01/12/05			0.29				4.9			
4FF	Overburden - 1st lift	Soil	J02725	01/12/05			0.39				5.1			
4FF	Overburden - 2nd lift	Soil	J02FY7	02/01/05	15.7		0.22		21700	C	5.6		6.2	C
4FF	Overburden - 2nd lift	Soil	J02FY8	02/01/05	12.3		0.21	U	11700	C	4.2		3.8	C
4FF	Overburden - 2nd lift	Soil	J02H03	02/01/05			0.35	U			4.4			
4FF	Overburden - 2nd lift	Soil	J02FY6	02/01/05	12.9		0.21	U	13500	C	4.5		5.6	C
4FF	Overburden - 2nd lift	Soil	J02FY9	02/01/05	12.4		0.21	U	11200	C	4		4	C
4FF	Overburden - 2nd lift	Soil	J02H00	02/01/05	13.2		0.26		12900	C	4.7		5	C
4FF	Overburden - 2nd lift	Soil	J02H02	02/01/05	12.1		0.21	U	12400	C	4.4		5	C
4FF	Overburden - 2nd lift	Soil	J02H01	02/01/05	11.3		0.35		11600	C	3.9		4.4	C
3FF	Overburden	Soil	J02FL1	01/25/05	16.3		0.21	U	23500	C	5.4		6.4	C
3FF	Overburden	Soil	J02FL2	01/25/05	26.5		0.21	U	21500	C	5.4		5.5	C
3FF	Overburden	Soil	J02FL3	01/25/05	16.7		0.21	U	23600	C	5.7		6.7	C
3FF	Overburden	Soil	J02FL4	01/25/05	14.5		0.21	U	21400	C	4.8		5.3	C
3FF	Overburden	Soil	J02FL5	01/25/05	16.1		0.23		24300	C	5.5		6.1	C
3FF	Overburden	Soil	J02FL6	01/25/05	14.6		0.22	U	22100	C	5		5.7	C
5FF	Suspect BCL - 16" spur	Soil	J02HJ2	02/11/05	17.5		0.21	U	23300	C	6.8	C	9	C
5FF	Suspect BCL - 16" spur	Soil	J02HJ4	02/11/05	17.1		0.21	U	23700	C	5.9	C	8.7	C
5FF	Suspect BCL - 16" spur	Soil	J02HJ5	02/11/05	17.1		0.21	U	23100	C	6.3	C	9.1	C
5FF	Suspect BCL - 16" spur	Soil	J02HJ6	02/11/05	17		0.21	U	24400	C	5.8	C	8.4	C
5FF	Suspect BCL - 16" spur	Soil	J02HJ7	02/11/05	15.6		0.21	U	20900	C	5.5	C	7.5	C
5FF	Suspect BCL - 16" spur	Soil	J02HJ8	02/11/05	16.4		0.21	U	22800	C	5.9	C	8.1	C
2FF	Suspect BCL - 18" spur	Soil	J02H56	02/16/05	17.6	C	0.2	U	22700	C	5.2		8.4	C
2FF	Suspect BCL - 18" spur	Soil	J02J00	02/16/05	16.1		0.376		23100	C	5.1		9.3	
2FF	Suspect BCL - 18" spur	Soil	J02H57	02/16/05	17	C	0.2	U	23000	C	5.9		8.4	C
2FF	Suspect BCL - 18" spur	Soil	J02H58	02/16/05	17.1	C	0.2	U	23300	C	5.9		9	C
2FF	Suspect BCL - 18" spur	Soil	J02H59	02/16/05	17.7	C	0.3		23400	C	5.8		8.9	C
2FF	Suspect BCL - 18" spur	Soil	J02HY8	02/17/05	15.9		0.21	U	22000		5.3		7.7	C
2FF	Suspect BCL - 18" spur	Soil	J02HY9	02/17/05	17.7		0.21	U	21500		4.9		7.1	C
2FF	Suspect BCL - 18" spur	Soil	J02H60	02/17/05	15.6		0.26		22500		5.3		7.6	C
1FF	Suspect BCL	Soil	J02HK4	04/04/05	17.8	C	0.207	U	25600	C	5.3		7.4	C
1FF	Suspect BCL	Soil	J02HJ9	04/05/05	0.17	C	0.2	U	106	C	0.325		0.069	C
1FF	Suspect BCL	Soil	J02HK0	04/05/05	16.9	C	0.367		25800	C	5.2		7.6	C
1FF	Suspect BCL	Soil	J02HK1	04/05/05	16.6	C	0.278		24400	C	4.5		7.1	C
1FF	Suspect BCL	Soil	J02HY7	04/05/05			0.35	U			4.7			
1FF	Suspect BCL	Soil	J02HK2	04/05/05	17.1	C	0.288		24700	C	5		7.1	C

Table A-5. Stockpile Sample Results Southern 100-C-9:1 (11 pages).

Stockpile Number	Stockpile Description	Media	HEIS Number	Date	Magnesium		Manganese		Mercury		Molybdenum		Nickel	
					mg/kg	Q	mg/kg	Q	mg/kg	Q	mg/kg	Q	mg/kg	Q
4FF	Overburden - 1st lift	Soil	J02720	01/12/05	4140	C	311		0.02	U	0.44		10.6	
4FF	Overburden - 1st lift	Soil	J02721	01/12/05					0.02	U				
4FF	Overburden - 1st lift	Soil	J02722	01/12/05					0.02	U				
4FF	Overburden - 1st lift	Soil	J02723	01/12/05					0.02	U				
4FF	Overburden - 1st lift	Soil	J02724	01/12/05					0.02	U				
4FF	Overburden - 1st lift	Soil	J02725	01/12/05					0.02					
4FF	Overburden - 2nd lift	Soil	J02FY7	02/01/05	4550		333	C	0.02	U	0.53	C	10.7	C
4FF	Overburden - 2nd lift	Soil	J02FY8	02/01/05	3990		264	C	0.02	U	0.16	UC	8.8	C
4FF	Overburden - 2nd lift	Soil	J02H03	02/01/05					0.011	B				
4FF	Overburden - 2nd lift	Soil	J02FY6	02/01/05	4150		324	C	0.02	U	0.18	UC	11.1	C
4FF	Overburden - 2nd lift	Soil	J02FY9	02/01/05	3820		262	C	0.01	U	0.14	UC	8.6	C
4FF	Overburden - 2nd lift	Soil	J02H00	02/01/05	3980		270	C	0.02	U	0.15	UC	9.1	C
4FF	Overburden - 2nd lift	Soil	J02H02	02/01/05	3820		256	C	0.02	U	0.23	C	9.2	C
4FF	Overburden - 2nd lift	Soil	J02H01	02/01/05	3290		249	C	0.02	U	0.13	C	7.2	C
3FF	Overburden	Soil	J02FL1	01/25/05	4530	C	326	C	0.02	U	0.57		10.4	
3FF	Overburden	Soil	J02FL2	01/25/05	3930	C	300	C	0.02	U	0.5		8.9	
3FF	Overburden	Soil	J02FL3	01/25/05	4430	C	340	C	0.02		0.55		10.3	
3FF	Overburden	Soil	J02FL4	01/25/05	3850	C	333	C	0.02	U	0.52		9.6	
3FF	Overburden	Soil	J02FL5	01/25/05	4660	C	338	C	0.02		0.41		11.5	
3FF	Overburden	Soil	J02FL6	01/25/05	4040	C	301	C	0.02	U	0.5		9.3	
5FF	Suspect BCL - 16" spur	Soil	J02HJ2	02/11/05	5290		349		0.02	U	0.71		14.9	C
5FF	Suspect BCL - 16" spur	Soil	J02HJ4	02/11/05	5280		353		0.02	U	0.64		14.2	C
5FF	Suspect BCL - 16" spur	Soil	J02HJ5	02/11/05	5430		363		0.04		0.63		14.6	C
5FF	Suspect BCL - 16" spur	Soil	J02HJ6	02/11/05	5210		357		0.02	U	0.68		13.9	C
5FF	Suspect BCL - 16" spur	Soil	J02HJ7	02/11/05	4500		361		0.02	U	0.62		12.4	C
5FF	Suspect BCL - 16" spur	Soil	J02HJ8	02/11/05	5010		352		0.02	U	0.61		13.1	C
2FF	Suspect BCL - 18" spur	Soil	J02H56	02/16/05	5170		347	C	0.02	U	0.32	C	12.3	
2FF	Suspect BCL - 18" spur	Soil	J02J00	02/16/05	5460	C	352		0.0074	U	0.73	U	13.1	
2FF	Suspect BCL - 18" spur	Soil	J02H57	02/16/05	5150		349	C	0.02	U	0.49	C	12.6	
2FF	Suspect BCL - 18" spur	Soil	J02H58	02/16/05	5280		372	C	0.003	U	0.354	C	13.5	
2FF	Suspect BCL - 18" spur	Soil	J02H59	02/16/05	5280		390	C	0.02	U	0.38	C	14.4	
2FF	Suspect BCL - 18" spur	Soil	J02HY8	02/17/05	4720	C	356		0.02		0.46		11.9	
2FF	Suspect BCL - 18" spur	Soil	J02HY9	02/17/05	4850	C	308		0.01	U	0.48		12.3	
2FF	Suspect BCL - 18" spur	Soil	J02H60	02/17/05	4940	C	334		0.02	U	0.38		12.5	
1FF	Suspect BCL	Soil	J02HK4	04/04/05	5260	C	367	C	0.017	U	0.798		12.2	C
1FF	Suspect BCL	Soil	J02HJ9	04/05/05	6.2	C	4.1	C	0.014	U	0.165	U	0.097	C
1FF	Suspect BCL	Soil	J02HK0	04/05/05	5230	C	386	C	0.013	U	0.741		11.9	C
1FF	Suspect BCL	Soil	J02HK1	04/05/05	5030	C	358	C	0.015	U	0.618		11.4	C
1FF	Suspect BCL	Soil	J02HY7	04/05/05					0.01	B				
1FF	Suspect BCL	Soil	J02HK2	04/05/05	4940	C	343	C	0.02		0.68		11.7	C

Stockpile Number	Sto
4FF	Overl
4FF	Overl
4FF	Overl
4FF	Overl
4FF	Overl
4FF	Overl
4FF	Overl
4FF	Overl
4FF	Overl
4FF	Overl
4FF	Overl
4FF	Overl
4FF	Overl
4FF	Overl
4FF	Overl
4FF	Overl
3FF	Overl
3FF	Overl
3FF	Overl
3FF	Overl
3FF	Overl
3FF	Overl
3FF	Overl
5FF	Suspe
5FF	Suspe
5FF	Suspe
5FF	Suspe
5FF	Suspe
5FF	Suspe
2FF	Suspe
2FF	Suspe
2FF	Suspe
2FF	Suspe
2FF	Suspe
2FF	Suspe
2FF	Suspe
2FF	Suspe
2FF	Suspe
1FF	Suspe
1FF	Suspe
1FF	Suspe
1FF	Suspe
1FF	Suspe
1FF	Suspe

Table A-5. Stockpile Sample Results Southern 100-C-9:1 (11 pages).

Stockpile Number	Stockpile Description	Media	HEIS Number	Date	Sodium		Strontium		Thallium		Tin		Titanium	
					mg/kg	Q	mg/kg	Q	mg/kg	Q	mg/kg	Q	mg/kg	Q
4FF	Overburden - 1st lift	Soil	J02720	01/12/05	157	C	23.1	C	0.51	U	0.82		1680	C
4FF	Overburden - 1st lift	Soil	J02721	01/12/05										
4FF	Overburden - 1st lift	Soil	J02722	01/12/05										
4FF	Overburden - 1st lift	Soil	J02723	01/12/05										
4FF	Overburden - 1st lift	Soil	J02724	01/12/05										
4FF	Overburden - 1st lift	Soil	J02725	01/12/05										
4FF	Overburden - 2nd lift	Soil	J02FY7	02/01/05	169	C	22.7		0.64	U	0.46	UC	1670	C
4FF	Overburden - 2nd lift	Soil	J02FY8	02/01/05	167	C	21		0.61	U	0.44	UC	223	C
4FF	Overburden - 2nd lift	Soil	J02H03	02/01/05										
4FF	Overburden - 2nd lift	Soil	J02FY6	02/01/05	154	C	21.8		0.68		0.49	UC	288	C
4FF	Overburden - 2nd lift	Soil	J02FY9	02/01/05	151	C	20.4		0.52	U	0.37	UC	154	C
4FF	Overburden - 2nd lift	Soil	J02H00	02/01/05	152	C	21.9		0.59	U	0.43	UC	251	C
4FF	Overburden - 2nd lift	Soil	J02H02	02/01/05	137	C	19.3		0.64	U	0.47	UC	248	C
4FF	Overburden - 2nd lift	Soil	J02H01	02/01/05	118	C	19.7		0.48	U	0.35	UC	155	C
3FF	Overburden	Soil	J02FL1	01/25/05	198	C	23.9	C	0.49	U	1.1	C	1990	C
3FF	Overburden	Soil	J02FL2	01/25/05	184	C	19.5	C	0.46	U	0.95	C	1890	C
3FF	Overburden	Soil	J02FL3	01/25/05	226	C	24.2	C	0.47	U	0.83	C	1980	C
3FF	Overburden	Soil	J02FL4	01/25/05	183	C	20.6	C	0.49	U	1.2	C	1640	C
3FF	Overburden	Soil	J02FL5	01/25/05	202	C	23.6	C	0.49	U	0.89	C	1950	C
3FF	Overburden	Soil	J02FL6	01/25/05	208	C	21.3	C	0.49	U	0.92	C	1810	C
5FF	Suspect BCL - 16" spur	Soil	J02HJ2	02/11/05	208	C	30		0.63	U	1.3	C	1540	C
5FF	Suspect BCL - 16" spur	Soil	J02HJ4	02/11/05	202	C	28.8		0.54	U	1.1	C	1530	C
5FF	Suspect BCL - 16" spur	Soil	J02HJ5	02/11/05	199	C	29.4		0.69	U	1.3	C	1430	C
5FF	Suspect BCL - 16" spur	Soil	J02HJ6	02/11/05	201	C	27.1		0.68	U	1.3	C	1500	C
5FF	Suspect BCL - 16" spur	Soil	J02HJ7	02/11/05	186	C	24.8		0.67	U	1.4	C	1460	C
5FF	Suspect BCL - 16" spur	Soil	J02HJ8	02/11/05	185	C	28.6		0.61	U	0.95	C	1340	C
2FF	Suspect BCL - 18" spur	Soil	J02H56	02/16/05	215	C	29.4	C	0.56	U	0.98	C	1620	C
2FF	Suspect BCL - 18" spur	Soil	J02J00	02/16/05	289	B	33.8	C	0.33	U	5.7	U	1520	C
2FF	Suspect BCL - 18" spur	Soil	J02H57	02/16/05	216	C	29.8	C	0.64	U	1.4	C	1660	C
2FF	Suspect BCL - 18" spur	Soil	J02H58	02/16/05	210	C	29.9	C	0.63	U	1.1	C	1670	C
2FF	Suspect BCL - 18" spur	Soil	J02H59	02/16/05	225	C	30.4	C	0.58	U	0.71	C	1780	C
2FF	Suspect BCL - 18" spur	Soil	J02HY8	02/17/05	230	C	35.1	C	0.66	U	0.8	C	1810	
2FF	Suspect BCL - 18" spur	Soil	J02HY9	02/17/05	245	C	25.7	C	0.61	U	0.65	C	1520	
2FF	Suspect BCL - 18" spur	Soil	J02H60	02/17/05	200	C	28.5	C	0.6	U	0.47	C	1620	
1FF	Suspect BCL	Soil	J02HK4	04/04/05	245	C	26.8	C	0.595	U	1.2	C	1920	C
1FF	Suspect BCL	Soil	J02HJ9	04/05/05	5.8	C	0.167	C	0.631	U	0.635	C	1.6	C
1FF	Suspect BCL	Soil	J02HK0	04/05/05	229	C	27.5	C	0.579	U	1.5	C	2120	C
1FF	Suspect BCL	Soil	J02HK1	04/05/05	221	C	23.8	C	0.447	U	1.1	C	1740	C
1FF	Suspect BCL	Soil	J02HY7	04/05/05										
1FF	Suspect BCL	Soil	J02HK2	04/05/05	235	C	24.2	C	0.515	U	1.2	C	1780	C

Table A-5. Stockpile Sample Results Southern 100-C-9:1 (11 pages).

Stockpile Number	Stockpile Description	Media	HEIS Number	Date	Uranium		Vanadium		Zinc		Zirconium	
					mg/kg	Q	mg/kg	Q	mg/kg	Q	mg/kg	Q
4FF	Overburden - 1st lift	Soil	J02720	01/12/05	1.9	U	50.3		40.2		20.5	
4FF	Overburden - 1st lift	Soil	J02721	01/12/05								
4FF	Overburden - 1st lift	Soil	J02722	01/12/05								
4FF	Overburden - 1st lift	Soil	J02723	01/12/05								
4FF	Overburden - 1st lift	Soil	J02724	01/12/05								
4FF	Overburden - 1st lift	Soil	J02725	01/12/05								
4FF	Overburden - 2nd lift	Soil	J02FY7	02/01/05	0.79	U	51.6		41.7		21.6	
4FF	Overburden - 2nd lift	Soil	J02FY8	02/01/05	0.76	U	11.4		29		2.7	
4FF	Overburden - 2nd lift	Soil	J02H03	02/01/05								
4FF	Overburden - 2nd lift	Soil	J02FY6	02/01/05	0.85	U	16.3		29.6		4	
4FF	Overburden - 2nd lift	Soil	J02FY9	02/01/05	0.64	U	9.7		27.8		4.8	
4FF	Overburden - 2nd lift	Soil	J02H00	02/01/05	0.74	U	14.5		28.8		4.6	
4FF	Overburden - 2nd lift	Soil	J02H02	02/01/05	0.8	U	14.3		26.7		4.1	
4FF	Overburden - 2nd lift	Soil	J02H01	02/01/05	0.6	U	12.7		23.9		9	
3FF	Overburden	Soil	J02FL1	01/25/05	1.9	U	58.6		48.1		23.2	
3FF	Overburden	Soil	J02FL2	01/25/05	1.8	U	57.3		65.1		19.1	
3FF	Overburden	Soil	J02FL3	01/25/05	2		57.7		46.2		23.9	
3FF	Overburden	Soil	J02FL4	01/25/05	1.9	U	49.9		38.8		20.5	
3FF	Overburden	Soil	J02FL5	01/25/05	1.9	U	59		45		18.8	
3FF	Overburden	Soil	J02FL6	01/25/05	1.9	U	55.7		40.1		18.1	
5FF	Suspect BCL - 16" spur	Soil	J02HJ2	02/11/05	0.79	U	54.3	C	51.2	C	17.5	
5FF	Suspect BCL - 16" spur	Soil	J02HJ4	02/11/05	0.67	U	54.2	C	49.6	C	17.9	
5FF	Suspect BCL - 16" spur	Soil	J02HJ5	02/11/05	0.85	U	51.4	C	50	C	17.1	
5FF	Suspect BCL - 16" spur	Soil	J02HJ6	02/11/05	0.85	U	54.6	C	49.1	C	17.9	
5FF	Suspect BCL - 16" spur	Soil	J02HJ7	02/11/05	0.83	U	49.3	C	43.3	C	16.1	
5FF	Suspect BCL - 16" spur	Soil	J02HJ8	02/11/05	0.76	U	49.7	C	46.8	C	16.2	
2FF	Suspect BCL - 18" spur	Soil	J02H56	02/16/05	0.69	U	52.3		47		19.8	
2FF	Suspect BCL - 18" spur	Soil	J02J00	02/16/05	14.4	U	52.5		2.1	U	171	
2FF	Suspect BCL - 18" spur	Soil	J02H57	02/16/05	0.79	U	53.9		46.4		19.7	
2FF	Suspect BCL - 18" spur	Soil	J02H58	02/16/05	0.78	U	55.1		47.6		20.2	
2FF	Suspect BCL - 18" spur	Soil	J02H59	02/16/05	0.72	U	57.7		47.9		20.1	
2FF	Suspect BCL - 18" spur	Soil	J02HY8	02/17/05	0.82	U	55.4		46.5		19.7	
2FF	Suspect BCL - 18" spur	Soil	J02HY9	02/17/05	0.75	U	50.7		42.6		19.4	
2FF	Suspect BCL - 18" spur	Soil	J02H60	02/17/05	0.75	U	54.4		46.5		20.1	
1FF	Suspect BCL	Soil	J02HK4	04/04/05	0.742	C	59.8		52.2	C	22.5	
1FF	Suspect BCL	Soil	J02HJ9	04/05/05	1.6	C	0.058	U	2.1	C	0.4	
1FF	Suspect BCL	Soil	J02HK0	04/05/05	0.722	UC	65		49.5	C	22.3	
1FF	Suspect BCL	Soil	J02HK1	04/05/05	0.557	UC	56.1		46.3	C	20.3	
1FF	Suspect BCL	Soil	J02HY7	04/05/05								
1FF	Suspect BCL	Soil	J02HK2	04/05/05	0.642	UC	59.1		47.4	C	20.1	

Table A-5. Stockpile Sample Results Southern 100-C-9:1 (11 pages).

Stockpile Number	Stockpile Description	Media	HEIS Number	Date	Americium-241			Carbon-14			Cesium-137			Cobalt-60			Europium-152		
					pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
4FF	Overburden - 1st lift	Soil	J02720	01/12/05	0.23	U	0.23	1.15	U	3.4	0.086	U	0.086	0.084	U	0.084	0.23	U	0.23
4FF	Overburden - 2nd lift	Soil	J02FY6	02/01/05	0.35	U	0.35	-1.57	U	3.5	0.082	U	0.082	0.09	U	0.09	0.2	U	0.2
3FF	Overburden	Soil	J02FL1	01/25/05	0.34	U	0.34	0.029	U	3	0.083	U	0.083	0.069	U	0.069	0.21	U	0.21
5FF	Suspect BCL - 16" spur	Soil	J02HJ3	02/11/05	0.25	U	0.25	0.636	U	3.6	0.11	U	0.11	0.11	U	0.11	0.27	U	0.27
2FF	Suspect BCL - 18" spur	Soil	J02H60	02/17/05	0.21	U	0.21	-0.491	U	3.5	0.091	U	0.091	0.095	U	0.095	0.2	U	0.2
1FF	Suspect BCL	Soil	J02HK5	04/04/05	0.19	U	0.19	0.952	U	4.5	0.073	U	0.073	0.098	U	0.098	0.19	U	0.19

Stockpile Number	Stockpile Description	Media	HEIS Number	Date	Europium-154			Europium-155			Nickel-63			Potassium-40			Radium-226		
					pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
4FF	Overburden - 1st lift	Soil	J02720	01/12/05	0.32	U	0.32	0.21	U	0.21	0.382	U	3.1	9.56		0.83	0.548		0.17
4FF	Overburden - 2nd lift	Soil	J02FY6	02/01/05	0.3	U	0.3	0.21	U	0.21	2.25	U	2.6	11		1	0.442		0.16
3FF	Overburden	Soil	J02FL1	01/25/05	0.3	U	0.3	0.21	U	0.21	-0.56	U	3.6	11.1		0.98	0.489		0.15
5FF	Suspect BCL - 16" spur	Soil	J02HJ3	02/11/05	0.33	U	0.33	0.23	U	0.23	-0.313	U	3.4	11		1.1	0.452		0.2
2FF	Suspect BCL - 18" spur	Soil	J02H60	02/17/05	0.28	U	0.28	0.18	U	0.18	0.723	U	3.2	10.4		0.85	0.422		0.16
1FF	Suspect BCL	Soil	J02HK5	04/04/05	0.24	U	0.24	0.18	U	0.18	0.263	U	3.2	10.7		0.86	0.471		0.14

Stockpile Number	Stockpile Description	Media	HEIS Number	Date	Radium-228			Thorium-228			Thorium-232			Total beta radiostrontium			Tritium		
					pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
4FF	Overburden - 1st lift	Soil	J02720	01/12/05	0.469		0.45	0.699		0.15	0.469		0.45	-0.106	U	0.31	0.24	U	0.38
4FF	Overburden - 2nd lift	Soil	J02FY6	02/01/05	0.576		0.41	0.535		0.08	0.576		0.41	-0.03	U	0.2	-0.939	U	3.2
3FF	Overburden	Soil	J02FL1	01/25/05	0.588		0.35	0.578		0.14	0.588		0.35	-0.148	U	0.31	-0.416	U	3.7
5FF	Suspect BCL - 16" spur	Soil	J02HJ3	02/11/05	0.981		0.44	0.721		0.096	0.981		0.44	0.057	U	0.26	1.27	U	4
2FF	Suspect BCL - 18" spur	Soil	J02H60	02/17/05	0.507		0.38	0.524		0.076	0.507		0.38	-0.023	U	0.22	1.71	U	4
1FF	Suspect BCL	Soil	J02HK5	04/04/05	0.651		0.36	0.45		0.11	0.651		0.36	-0.01	U	0.22	1.27	U	3.7

Stockpile Number	Stockpile Description	Media	HEIS Number	Date	Uranium-235			Uranium-238		
					pCi/g	Q	MDA	pCi/g	Q	MDA
4FF	Overburden - 1st lift	Soil	J02720	01/12/05	0.31	U	0.31	10	U	10
4FF	Overburden - 2nd lift	Soil	J02FY6	02/01/05	0.3	U	0.3	11	U	11
3FF	Overburden	Soil	J02FL1	01/25/05	0.32	U	0.32	10	U	10
5FF	Suspect BCL - 16" spur	Soil	J02HJ3	02/11/05	0.35	U	0.35	11	U	11
2FF	Suspect BCL - 18" spur	Soil	J02H60	02/17/05	0.28	U	0.28	10	U	10
1FF	Suspect BCL	Soil	J02HK5	04/04/05	0.27	U	0.27	9.3	U	9.3

Table A-5. Stockpile Sample Results Southern 100-C-9:1 (11 pages).

Constituent	J02720 01/12/05 4FF Overburden - 1st lift		J02FL1 01/12/05 3FF Overburden		J02FY6 02/01/05 4FF Overburden - 2nd lift		J02H60 02/17/05 2FF Suspect BCL - 18" spur		J02HJ2 02/11/05 5FF Suspect BCL - 16" spur		J02HK4 04/04/05 5FF Suspect BCL	
	ug/kg	Q	ug/kg	Q	ug/kg	Q	ug/kg	Q	ug/kg	Q	ug/kg	Q
	Semivolatile Organics											
1,2,4-Trichlorobenzene	360	U	360	U	350	U	350	U	350	U	350	U
1,2-Dichlorobenzene	360	U	360	U	350	U	350	U	350	U	350	U
1,3-Dichlorobenzene	360	U	360	U	350	U	350	U	350	U	350	U
1,4-Dichlorobenzene	360	U	360	U	350	U	350	U	350	U	350	U
2,4,5-Trichlorophenol	900	U	890	U	880	U	860	U	880	U	860	U
2,4,6-Trichlorophenol	360	U	360	U	350	U	350	U	350	U	350	U
2,4-Dichlorophenol	360	U	360	U	350	U	350	U	350	U	350	U
2,4-Dimethylphenol	360	U	360	U	350	U	350	U	350	U	350	U
2,4-Dinitrophenol	900	U	890	U	880	U	860	U	880	U	860	U
2,4-Dinitrotoluene	360	U	360	U	350	U	350	U	350	U	350	U
2,6-Dinitrotoluene	360	U	360	U	350	U	350	U	350	U	350	U
2-Chloronaphthalene	360	U	360	U	350	U	350	U	350	U	350	U
2-Chlorophenol	360	U	360	U	350	U	350	U	350	U	350	U
2-Methylnaphthalene	360	U	360	U	71	J	350	U	350	U	350	U
2-Methylphenol (cresol, o-)	360	U	360	U	350	U	350	U	350	U	350	U
2-Nitroaniline	900	U	890	U	880	U	860	U	880	U	860	U
2-Nitrophenol	360	U	360	U	350	U	350	U	350	U	350	U
3+4 Methylphenol (cresol, m+p)	360	U	360	U	350	U	350	U	350	U	350	U
3,3'-Dichlorobenzidine	360	U	360	U	350	U	350	U	350	U	350	U
3-Nitroaniline	900	U	890	U	880	U	860	U	880	U	860	U
4,6-Dinitro-2-methylphenol	900	U	890	U	880	U	860	U	880	U	860	U
4-Bromophenylphenyl ether	360	U	360	U	350	U	350	U	350	U	350	U
4-Chloro-3-methylphenol	360	U	360	U	350	U	350	U	350	U	350	U
4-Chloroaniline	360	U	360	U	350	U	350	U	350	U	350	U
4-Chlorophenylphenyl ether	360	U	360	U	350	U	350	U	350	U	350	U
4-Nitroaniline	900	U	890	U	880	U	860	U	880	U	860	U
4-Nitrophenol	900	U	890	U	880	U	860	U	880	U	860	U
Acenaphthene	360	U	360	U	230	J	350	U	350	U	350	U
Acenaphthylene	360	U	360	U	350	U	350	U	350	U	350	U

Table A-5. Stockpile Sample Results Southern 100-C-9:1 (11 pages).

Constituent	J02720 01/12/05 4FF		J02FL1 01/12/05 3FF		J02FY6 02/01/05 4FF		J02H60 02/17/05 2FF		J02HJ2 02/11/05 5FF		J02HK4 04/04/05 5FF	
	Overburden - 1st lift		Overburden		Overburden - 2nd lift		Suspect BCL - 18" spur		Suspect BCL - 16" spur		Suspect BCL	
	ug/kg	Q	ug/kg	Q	ug/kg	Q	ug/kg	Q	ug/kg	Q	ug/kg	Q
Anthracene	360	U			910		350	U	350	U	350	U
Benzo(a)anthracene	19	J	360	U	1300		350	U	350	U	65.999	J
Benzo(a)pyrene	360	U	360	U	690		350	U	350	U	49.962	J
Benzo(b)fluoranthene	360	U	360	U	720		350	U	350	U	40.793	J
Benzo(ghi)perylene	360	U	360	U	250	J	350	U	350	U	23.528	J
Benzo(k)fluoranthene	360	U	360	U	670		350	U	350	U	58.093	J
Bis(2-chloro-1-methylethyl)ether	360	U	360	U	350	U	350	U	350	U	350	U
Bis(2-Chloroethoxy)methane	360	U	360	U	350	U	350	U	350	U	350	U
Bis(2-chloroethyl) ether	360	U	360	U	350	U	350	U	350	U	350	U
Bis(2-ethylhexyl) phthalate	360	U	360	U	84	JB	39	JB	43	JB	57.142	JBC
Butylbenzylphthalate	360	U	140	JB	350	U	350	U	350	U	350	U
Carbazole	360	U	360	U	650		350	U	350	U	350	U
Chrysene	19	J	360	U	1400		350	U	350	U	72.556	J
Di-n-butylphthalate	360	U	25	J	29	JB	350	U	350	U	350	UC
Di-n-octylphthalate	360	U	39	J	350	U	350	U	350	U	350	U
Dibenz[a,h]anthracene	360	U	360	U	150	J	350	U	350	U	350	U
Dibenzofuran	360	U	360	U	200	J	350	U	350	U	350	U
Diethylphthalate	360	U	360	U	350	U	350	U	350	U	350	U
Dimethyl phthalate	360	U	360	U	350	U	350	U	350	U	350	U
Fluoranthene	61	J	360	U	2400		350	U	350	U	85.064	J
Fluorene	360	U	35	J	440		350	U	350	U	350	U
Hexachlorobenzene	360	U	360	U	350	U	350	U	350	U	350	U
Hexachlorobutadiene	360	U	360	U	350	U	350	U	350	U	350	U
Hexachlorocyclopentadiene	360	U	360	U	350	U	350	U	350	U	350	U
Hexachloroethane	360	U	360	U	350	U	350	U	350	U	350	U
Indeno[1,2,3-cd]pyrene	360	U	360	U	280	J	350	U	350	U	21.244	J
Isophorone	360	U	360	U	350	U	350	U	350	U	350	U
N-Nitroso-di-n-dipropylamine	360	U	360	U	350	U	350	U	350	U	350	U
N-Nitrosodiphenylamine	360	U	360	U	350	U	350	U	350	U	350	U
Naphthalene	360	U	360	U	97	J	350	U	350	U	350	U
Nitrobenzene	360	U	360	U	350	U	350	U	350	U	350	U
Pentachlorophenol	900	U	360	U	880	U	860	U	880	U	860	U
Phenanthrene	42	J	890	U	2300		350	U	350	U	37.835	J
Phenol	360	U	18	J	350	U	350	U	350	U	350	U
Pyrene	48	J	360	U	2100		350	U	350	U	106.309	JBC

Table A-5. Stockpile Sample Results Southern 100-C-9:1 (11 pages)

Stockpile Number	Stockpile Description	Media	HEIS Number	Sample Date	TCLP 1,4-Dichlorobenzene		TCLP 2,4,5-Trichlorophenol		TCLP 2,4,6-Trichlorophenol		TCLP 2,4-Dinitrotoluene	
					ug/L	Q	ug/L	Q	ug/L	Q	ug/L	Q
3FF	Overburden	Soil	J02FL1	01/25/05	0.05	U	0.12	U	0.05	U	0.05	U
4FF	Overburden - 2nd lift	Soil	J02FY6	02/01/05	0.05	U	0.12	U	0.05	U	0.05	U
2FF	Suspect BCL - 18" spur	Soil	J02H60	02/17/05	0.05	U	0.1	U	0.05	U	0.05	U
5FF	Suspect BCL - 16" spur	Soil	J02HJ2	02/11/05	0.05	U	0.12	U	0.05	U	0.05	U
1FF	Suspect BCL	Soil	J02HK4	04/04/05	0.05	U	0.12	U	0.05	U	0.05	U

Stockpile Number	Stockpile Description	Media	HEIS Number	Sample Date	TCLP 2-Methylphenol (cresol,		TCLP 3+4 Methylphenol (cresol,		TCLP Hexachlorobenzene		TCLP Hexachlorobutadiene	
					ug/L	Q	ug/L	Q	ug/L	Q	ug/L	Q
3FF	Overburden	Soil	J02FL1	01/25/05	0.05	U	0.05	U	0.05	U	0.05	U
4FF	Overburden - 2nd lift	Soil	J02FY6	02/01/05	0.05	U	0.05	U	0.05	U	0.05	U
2FF	Suspect BCL - 18" spur	Soil	J02H60	02/17/05	0.05	U	0.05	U	0.05	U	0.05	U
5FF	Suspect BCL - 16" spur	Soil	J02HJ2	02/11/05	0.05	U	0.05	U	0.05	U	0.05	U
1FF	Suspect BCL	Soil	J02HK4	04/04/05	0.05	U	0.05	U	0.05	U	0.05	U

Stockpile Number	Stockpile Description	Media	HEIS Number	Sample Date	TCLP Hexachloroethane		TCLP Nitrobenzene		TCLP Pentachlorophenol		TCLP Pyridine	
					ug/L	Q	ug/L	Q	ug/L	Q	ug/L	Q
3FF	Overburden	Soil	J02FL1	01/25/05	0.05	U	0.05	U	0.12	U	0.05	U
4FF	Overburden - 2nd lift	Soil	J02FY6	02/01/05	0.05	U	0.05	U	0.12	U	0.05	U
2FF	Suspect BCL - 18" spur	Soil	J02H60	02/17/05	0.05	U	0.05	U	0.1	U	0.05	U
5FF	Suspect BCL - 16" spur	Soil	J02HJ2	02/11/05	0.05	U	0.05	U	0.12	U	0.05	U
1FF	Suspect BCL	Soil	J02HK4	04/04/05	0.05	U	0.05	U	0.12	U	0.05	U

Stockpile Number	Stockpile Description	Media	HEIS Number	Sample Date	TCLP Arsenic		TCLP Barium		TCLP Cadmium		TCLP Chromium	
					mg/L	Q	mg/L	Q	mg/L	Q	mg/L	Q
3FF	Overburden	Soil	J02FL1	01/25/05	15.6	U	190	C	1.8	U	11.5	
5FF	Suspect BCL - 16" spur	Soil	J02HJ2	02/11/05	17.4	U	307	C	2.4	U	2.7	C
1FF	Suspect BCL	Soil	J02HK4	04/04/05	19.8		175	C	2.4	U	6.1	C

Stockpile Number	Stockpile Description	Media	HEIS Number	Sample Date	TCLP Lead		TCLP Mercury		TCLP Selenium		TCLP Silver	
					mg/L	Q	mg/L	Q	mg/L	Q	mg/L	Q
3FF	Overburden	Soil	J02FL1	01/25/05	13.2	U	0.1	U	22.2	U	6	U
5FF	Suspect BCL - 16" spur	Soil	J02HJ2	02/11/05	11.4	U	0.1	U	24	U	3	UC
1FF	Suspect BCL	Soil	J02HK4	04/04/05	11.4	UC	0.1	U	24	U	3	U

Table A-6. Sampling Results from the Eastern End of the Sourthern 100-C-9:1 Excavation. (3 Pages)

Sample Location (relative to the twin box culvert)	Sample Number	Sample Date	Americium-241 GEA			Cesium-137			Cobalt-60			Europium-152			Europium-154		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
Soil (under the north box)	J11XK4	4/18/06	0.22	U	0.22	0.061	U	0.061	0.072	U	0.072	0.16	U	0.16	0.22	U	0.22
Soil (under the south box)	J11XK5	4/18/06	0.22	U	0.22	0.055	U	0.055	0.057	U	0.057	0.14	U	0.14	0.24	U	0.24
Concrete (top exterior)	J11XN8	4/18/06	0.27	U	0.27	0.072	U	0.072	0.091	U	0.091	0.18	U	0.18	0.25	U	0.25
Concrete (north box interior)	J11XN9	4/18/06	0.25	U	0.25	0.078	U	0.078	0.084	U	0.084	0.18	U	0.18	0.24	U	0.24
	J11XX5	4/18/06	0.2	U	0.2	0.083	U	0.083	0.066	U	0.066	0.18	U	0.18	0.3	U	0.3

Sample Location (relative to the twin box culvert)	Sample Number	Sample Date	Europium-155			Potassium-40			Radium-226			Radium-228			Thorium-228 GEA		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
Soil (under the north box)	J11XK4	4/18/06	0.17	U	0.17	6.55		0.55	0.16		0.13	0.369		0.26	0.316		0.075
Soil (under the south box)	J11XK5	4/18/06	0.15	U	0.15	7.51		0.076	0.247		0.12	0.664		0.24	0.333		0.066
Concrete (top exterior)	J11XN8	4/18/06	0.22	U	0.22	4.61		0.83	0.28		0.13	0.394		0.32	0.198		0.086
Concrete (north box interior)	J11XN9	4/18/06	0.19	U	0.19	4.95		0.94	0.296		0.13	0.368		0.24	0.225		0.08
Concrete (south box interior)	J11XX5	4/18/06	0.18	U	0.18	5.61		0.76	0.372		0.15	0.43	U	0.43	0.318		0.079

Sample Location (relative to the twin box culvert)	Sample Number	Sample Date	Thorium-232 GEA			Uranium-235 GEA			Uranium-238 GEA		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
Soil (under the north box)	J11XK4	4/18/06	0.369		0.26	0.22	U	0.22	7.9	U	7.9
Soil (under the south box)	J11XK5	4/18/06	0.664		0.24	0.23	U	0.23	7.3	U	7.3
Concrete (top exterior)	J11XN8	4/18/06	0.394		0.32	0.28	U	0.28	10	U	10
Concrete (north box interior)	J11XN9	4/18/06	0.368		0.24	0.22	U	0.22	8.2	U	8.2
Concrete (south box interior)	J11XX5	4/18/06	0.43	U	0.43	0.29	U	0.29	10	U	10

Table A-6. Sampling Results from the Eastern End of the Southern 100-C-9:1 Excavation. (3 Pages)

Sample Location (relative to the twin box culvert)	Sample Number	Sample Date	Aluminum			Antimony			Arsenic			Barium			Beryllium			Boron		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
Soil (under the north box)	J11XK4	4/18/06	3830		7.7	1.2	U	1.2	2.7		1.6	44.1	C	0.05	0.18		0.05	2.9		0.64
Soil (under the south box)	J11XK5	4/18/06	3090		7.7	1.2	U	1.2	2.1		1.6	35.2	C	0.05	0.14		0.05	0.77		0.64
Concrete (top exterior)	J11XN8	4/18/06							51.1		0.54	128	C	0.02						
Concrete (north box interior)	J11XN9	4/18/06							64.7		0.52	107	C	0.02						
Concrete (south box interior)	J11XX5	4/18/06							51.6		0.52	97.4	C	0.02						

Sample Location (relative to the twin box culvert)	Sample Number	Sample Date	Cadmium			Calcium			Chromium			Cobalt			Copper			Hexavalent Chromium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
Soil (under the north box)	J11XK4	4/18/06	0.19	U	0.19	5440		4.4	14.7		0.35	7.9		0.37	25.7		0.32	0.49		0.21
Soil (under the south box)	J11XK5	4/18/06	0.19	U	0.19	4710		4.4	5.6		0.35	7.4		0.37	13.4		0.32	0.21	U	0.21
Concrete (top exterior)	J11XK6	4/18/06																0.35	U	0.35
Concrete (top exterior)	J11XN8	4/18/06	0.15		0.06				9.2		0.12									
Concrete (north box interior)	J11XK7	4/18/06																165		0.35
Concrete (north box interior)	J11XN9	4/18/06	0.92		0.06				306		0.11									
Concrete (south box interior)	J11XX5	4/18/06	0.96		0.06				377		0.11									
Concrete (south box interior)	J11XX2	4/18/06																117		0.35

Table A-6. Sampling Results from the Eastern End of the Southern 100-C-9:1 Excavation. (3 Pages)

Sample Location (relative to the twin box culvert)	Sample Number	Sample Date	Iron			Lead			Lithium			Magnesium			Manganese			Mercury		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
Soil (under the north box)	J11XK4	4/18/06	19500		9.3	13.1		0.83	3.3		0.08	3300		2.6	275		0.08	1.8		0.07
Soil (under the south box)	J11XK5	4/18/06	19700		9.3	2.1		0.82	2.7		0.08	3250		2.6	299		0.08	2.9		0.06
Concrete (top exterior)	J11XN8	4/18/06				5		0.28										0.01	U	0.01
Concrete (north box interior)	J11XN9	4/18/06				6.4		0.27										2		0.02
Concrete (south box interior)	J11XX5	4/18/06				5.7		0.26										1.7		0.02

Sample Location (relative to the twin box culvert)	Sample Number	Sample Date	Molybdenum			Nickel			Phosphorus			Potassium			Selenium			Silicon		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
Soil (under the north box)	J11XK4	4/18/06	0.78	U	0.78	5.7		0.64	1250		2.4	717		6.1	1.3	U	1.3	385		6.1
Soil (under the south side)	J11XK5	4/18/06	0.77	U	0.77	6.1		0.64	1370		4	597		6	1.3	U	1.3	313		6
Concrete (top exterior)	J11XN8	4/18/06													0.42	U				
Concrete (north box interior)	J11XN9	4/18/06													0.4	U				
Concrete (south box interior)	J11XX5	4/18/06													0.34	U				

Sample Location (relative to the twin box culvert)	Sample Number	Sample Date	Silver			Sodium			Strontium			Thallium			Tin			Titanium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
Soil (under the north box)	J11XK4	4/18/06	0.19	U	0.19	274		2	15.4	C	0.03	1.9	U	1.9	4.5	C	2.9	1710	C	0.08
Soil (under the south box)	J11XK5	4/18/06	0.19	U	0.19	260		2	12.8	C	0.03	1.9	U	1.9	2.8	UC	2.8	1440	C	0.08
Concrete (top exterior)	J11XN8	4/18/06	0.06	U																
Concrete (north box interior)	J11XN9	4/18/06	0.06	U																
Concrete (south box interior)	J11XX5	4/18/06	0.06	U																

Sample Location (relative to the twin box culvert)	Sample Number	Sample Date	Uranium			Vanadium			Zinc			Zirconium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
Soil (under the north side)	J11XK4	4/18/06	2.4	UC	2.4	48.7		0.24	37.4		0.43	22.6		0.86
Soil (under the south box)	J11XK5	4/18/06	2.3	UC	2.3	39.5		0.24	32.8		0.43	19.7		0.85

Table A-7. Waste Characterization Sample Results Southern 100-C-9:1 (5 pages).

Sample Location	Media	HEIS Number	Sample Date	Aluminum		Antimony		Arsenic		Barium		Beryllium		Boron		Cadmium	
				mg/kg	Q	mg/kg	Q	mg/kg	Q	mg/kg	Q	mg/kg	Q	mg/kg	Q	mg/kg	Q
Between 100-C-7 and 1st spur line	Pink anomalous soil	J02H52	02/01/05	3260	C	0.16		3.9		30	C	0.58		2.6	C	0.09	
Between 100-C-7 and 1st spur line	Red anomalous soil	J02HB6	02/07/05	8770	C	5		26	C	56.5	C	0.33		3.7	C	4.6	
Between 100-C-7 and 1st spur line	Pink anomalous soil	J02HJ1	02/10/05	27000		0.6		2.2		23.2	C	0.38		2.5		0.85	
ACL Stockpile (ERDF)	Soil	J03JT1	06/29/05	6900		2.2	U	4.6		64.3	C	0.14		1.3	UC	1.5	
18"spur (adjacent to 100-C-7)	Oily soil	J02FL0	01/20/05	17000	C	0.46		3.4		97.5	C	0.84		7.2		0.46	

Sample Location	Media	HEIS Number	Sample Date	Calcium		Chromium		Cobalt		Copper		Cyanide		Hexavalent Chromium		Iron	
				mg/kg	Q	mg/kg	Q	mg/kg	Q	mg/kg	Q	mg/kg	Q	mg/kg	Q	mg/kg	Q
Between 100-C-7 and 1st spur line	Pink anomalous soil	J02H52	02/01/05	31700	C	3.7	C	5.6				0.34	U			13400	C
Between 100-C-7 and 1st spur line	Pink anomalous soil	J02H53	02/01/05											0.35	U		
Between 100-C-7 and 1st spur line	Red anomalous soil	J02HB5	02/07/05											0.35	U		
Between 100-C-7 and 1st spur line	Red anomalous soil	J02HB6	02/07/05	11100	C	38	C	14.7		114	C					210000	C
Between 100-C-7 and 1st spur line	Pink anomalous soil	J02HH6	02/10/05											0.35	U		
Between 100-C-7 and 1st spur line	Pink anomalous soil	J02HJ1	02/10/05	2640	C	44.4	C	1.7	C	8.1		0.61	U			7290	C
ACL Stockpile (ERDF)	Soil	J03JT1	06/29/05	8640		11.3	C	8.6		17.3						21900	
18"spur (adjacent to 100-C-7)	Oily soil	J02FL0	01/20/05	5190	C	76.4		8.6								23000	

Sample Location	Media	HEIS Number	Sample Date	Lead		Lithium		Magnesium		Manganese		Mercury		Molybdenum		Nickel	
				mg/kg	Q	mg/kg	Q	mg/kg	Q	mg/kg	Q	mg/kg	Q	mg/kg	Q	mg/kg	Q
Between 100-C-7 and 1st spur line	Pink anomalous soil	J02H52	02/01/05	2.6		4.7	C	4550				0.02	U	0.38	C	6.7	C
Between 100-C-7 and 1st spur line	Red anomalous soil	J02HB6	02/07/05	461		1.7	C	1360	C	562		227		7.1		37.7	
Between 100-C-7 and 1st spur line	Pink anomalous soil	J02HJ1	02/10/05	226		1.8	C	784		59.6		1.8		1.3		2.9	C
ACL Stockpile (ERDF)	Soil	J03JT1	06/29/05	7.3		7.1	C	5660		364		0.1		0.96		12.2	
18"spur (adjacent to 100-C-7)	Oily soil	J02FL0	01/20/05	70.2		7.6	C	6570				0.84		0.72		29.3	

Attachment to Waste Site Reclassification Form 2004-012

Table A-7. Waste Characterization Sample Results Southern 100-C-9:1 (5 pages).

Sample Location	Media	HEIS Number	Sample Date	Phosphorus		Potassium		Selenium		Silicon		Silver		Sodium		Strontium	
				mg/kg	Q	mg/kg	Q	mg/kg	Q	mg/kg	Q	mg/kg	Q	mg/kg	Q	mg/kg	Q
Between 100-C-7 and 1st spur line	Pink anomalous soil	J02H52	02/01/05	899		829	C	0.23	U	179	C	0.03	U	257	C	65.7	
Between 100-C-7 and 1st spur line	Red anomalous soil	J02HB6	02/07/05	992		254	C	2.3	U	1110	C	0.29	U	139	C	24.1	C
Between 100-C-7 and 1st spur line	Pink anomalous soil	J02HJ1	02/10/05	31.4	C	385	C	0.48	U	450		0.15		53.1	C	7.9	
ACL Stockpile (ERDF)	Soil	J03JT1	06/29/05	970		1260		2.7	U	262		0.49	U	238		26.6	C
18"spur (adjacent to 100-C-7)	Oily soil	J02FL0	01/20/05	1000		1730	C	0.54	U	43.5		0.07	U	235	C	35.5	

Sample Location	Media	HEIS Number	Sample Date	Sulfide		Thallium		Tin		Titanium		Uranium		Vanadium		Zinc	
				mg/kg	Q	mg/kg	Q	mg/kg	Q	mg/kg	Q	mg/kg	Q	mg/kg	Q	mg/kg	Q
Between 100-C-7 and 1st spur line	Pink anomalous soil	J02H52	02/01/05	25.9	U	0.37	U	0.41	C	822	C	0.46	U	29		26.1	
Between 100-C-7 and 1st spur line	Red anomalous soil	J02HB6	02/07/05			3.7		9.2	C	617	C	4.7	U	35.3	C	671	
Between 100-C-7 and 1st spur line	Pink anomalous soil	J02HJ1	02/10/05	49.3	U	0.77	U	1.9	C	368	C	1.5		60.6	C	82	C
ACL Stockpile (ERDF)	Soil	J03JT1	06/29/05			4.3	U	3.1	UC	1660	C	10.8	U	50.1		46.6	
18"spur (adjacent to 100-C-7)	Oily soil	J02FL0	01/20/05			0.88	U	1.9	C	1590		2.6		63.1		470	

Sample Location	Media	HEIS Number	Sample Date	Zirconium		TPH	
				mg/kg	Q	mg/kg	Q
Between 100-C-7 and 1st spur line	Pink anomalous soil	J02H52	02/01/05	7.8			
Between 100-C-7 and 1st spur line	Red anomalous soil	J02HB6	02/07/05	8.9			
Between 100-C-7 and 1st spur line	Pink anomalous soil	J02HJ1	02/10/05	22.7			
ACL Stockpile (ERDF)	Soil	J03JT1	06/29/05	8.2			
18"spur (adjacent to 100-C-7)	Oily soil	J02FL0	01/20/05	21.6		49.8	U

Table A-7. Waste Characterization Results Southern 100-C-9:1 (5 pages).

Sample Location	Media	HEIS Number	Sample Date	TCLP 1,4-Dichlorobenzene		TCLP 2,4,5-Trichlorophenol		TCLP 2,4,6-Trichlorophenol		TCLP 2,4-Dinitrotoluene	
				ug/L	Q	ug/L	Q	ug/L	Q	ug/L	Q
Between 100-C-7 and 1st spur line	Pink anomalous soil	J02H52	02/01/05	0.05	U	0.12	U	0.05	U	0.05	U
Between 100-C-7 and 1st spur line	Red anomalous soil	J02HB6	02/07/05	0.05	U	0.12	U	0.05	U	0.05	U
Between 100-C-7 and 1st spur line	Pink anomalous soil	J02HJ1	02/10/05	0.05	U	0.12	U	0.05	U	0.05	U
18"spur (adjacent to 100-C-7)	Oily soil	J02FL0	01/20/05	0.05	U	0.12	U	0.05	U	0.05	U

Sample Location	Media	HEIS Number	Sample Date	TCLP 2-Methylphenol (cresol, o-)		TCLP 3+4 Methylphenol (cresol, m+p)		TCLP Hexachlorobenzene		TCLP Hexachlorobutadiene	
				ug/L	Q	ug/L	Q	ug/L	Q	ug/L	Q
Between 100-C-7 and 1st spur line	Pink anomalous soil	J02H52	02/01/05	0.05	U	0.05	U	0.05	U	0.05	U
Between 100-C-7 and 1st spur line	Red anomalous soil	J02HB6	02/07/05	0.05	U	0.05	U	0.05	U	0.05	U
Between 100-C-7 and 1st spur line	Pink anomalous soil	J02HJ1	02/10/05	0.05	U	0.05	U	0.05	U	0.05	U
18"spur (adjacent to 100-C-7)	Oily soil	J02FL0	01/20/05	0.05	U	0.05	U	0.05	U	0.05	U

Sample Location	Media	HEIS Number	Sample Date	TCLP Hexachloroethane		TCLP Nitrobenzene		TCLP Pentachlorophenol		TCLP Pyridine	
				ug/L	Q	ug/L	Q	ug/L	Q	ug/L	Q
Between 100-C-7 and 1st spur line	Pink anomalous soil	J02H52	02/01/05	0.05	U	0.05	U	0.12	U	0.05	U
Between 100-C-7 and 1st spur line	Red anomalous soil	J02HB6	02/07/05	0.05	U	0.05	U	0.12	U	0.05	U
Between 100-C-7 and 1st spur line	Pink anomalous soil	J02HJ1	02/10/05	0.05	U	0.05	U	0.12	U	0.05	U
18"spur (adjacent to 100-C-7)	Oily soil	J02FL0	01/20/05	0.05	U	0.05	U	0.12	U	0.05	U

Sample Location	Media	HEIS Number	Sample Date	TCLP Arsenic		TCLP Barium		TCLP Cadmium		TCLP Chromium	
				mg/L	Q	mg/L	Q	mg/L	Q	mg/L	Q
Between 100-C-7 and 1st spur line	Pink anomalous soil	J02H52	02/01/05	56.6		166	C	2.4	UC	2.4	U
Between 100-C-7 and 1st spur line	Red anomalous soil	J02HB6	02/07/05	17.4	U	468	C	11.6		7	
Between 100-C-7 and 1st spur line	Pink anomalous soil	J02HJ1	02/10/05	17.4	U	242	C	5.7		2.6	UC
ACL Stockpile (ERDF)	Soil	J03JT1	06/29/05	30.5	U	299		4.7	U	59.2	
18"spur (adjacent to 100-C-7)	Oily soil	J02FL0	01/20/05	17.4	U	230	C	2.4	U	30.8	

Sample Location	Media	HEIS Number	Sample Date	TCLP Lead		TCLP Mercury		TCLP Selenium		TCLP Silver	
				mg/L	Q	mg/L	Q	mg/L	Q	mg/L	Q
Between 100-C-7 and 1st spur line	Pink anomalous soil	J02H52	02/01/05	11.4	U	0.1	U	24	U	3	U
Between 100-C-7 and 1st spur line	Red anomalous soil	J02HB6	02/07/05	1050		0.65		24	U	3	U
Between 100-C-7 and 1st spur line	Pink anomalous soil	J02HJ1	02/10/05	29.2		0.1	U	24	U	3	UC
ACL Stockpile (ERDF)	Soil	J03JT1	06/29/05	32.7	U	0.1	U	48.5	U	5.6	U
18"spur (adjacent to 100-C-7)	Oily soil	J02FL0	01/20/05	15.6		0.1	U	24	U	3	U

Table A-7. Waste Characterization Sample Results Southern 100-C-9:1 (5 pages)

Constituent	J02FL0 01/20/05 18"spur (adjacent to 100-C-7)		J02HJ1 02/10/05 Between 100-C-7 and 1st spur line	
	ug/kg	Q	ug/kg	Q
Polychlorinated Biphenyls				
Aroclor-1016	150	U		
Aroclor-1221	150	U		
Aroclor-1232	150	U		
Aroclor-1242	150	U		
Aroclor-1248	150	U		
Aroclor-1254	70			
Aroclor-1260	150	U		
Semivolatile Organics				
1,2,4-Trichlorobenzene	500	U	430	U
1,2-Dichlorobenzene	500	U	430	U
1,3-Dichlorobenzene	500	U	430	U
1,4-Dichlorobenzene	500	U	430	U
2,4,5-Trichlorophenol	1200	U	1100	U
2,4,6-Trichlorophenol	500	U	430	U
2,4-Dichlorophenol	500	U	430	U
2,4-Dimethylphenol	500	U	430	U
2,4-Dinitrophenol	1200	U	1100	U
2,4-Dinitrotoluene	500	U	430	U
2,6-Dinitrotoluene	500	U	430	U
2-Chloronaphthalene	500	U	430	U
2-Chlorophenol	500	U	430	U
2-Methylnaphthalene	500	U	430	U
2-Methylphenol (cresol, o-)	500	U	430	U
2-Nitroaniline	1200	U	1100	U
2-Nitrophenol	500	U	430	U
3+4 Methylphenol (cresol, m+p)	500	U	430	U
3,3'-Dichlorobenzidine	500	U	430	U
3-Nitroaniline	1200	U	1100	U
4,6-Dinitro-2-methylphenol	1200	U	1100	U
4-Bromophenylphenyl ether	500	U	430	U
4-Chloro-3-methylphenol	500	U	430	U
4-Chloroaniline	500	U	430	U
4-Chlorophenylphenyl ether	500	U	430	U
4-Nitroaniline	1200	U	1100	U
4-Nitrophenol	1200	U	1100	U
Acenaphthene	500	U	430	U
Acenaphthylene	500	U	430	U
Anthracene	500	U	430	U
Benzo(a)anthracene	500	U	160	J
Benzo(a)pyrene	36	J	180	J
Benzo(b)fluoranthene	81	J	190	J
Benzo(ghi)perylene	500	U	94	J
Benzo(k)fluoranthene	73	J	210	J
Bis(2-chloro-1-methylethyl)ether	500	U	430	U
Bis(2-Chloroethoxy)methane	500	U	430	U
Bis(2-chloroethyl) ether	500	U	430	U

Table A-7. Waste Characterization Sample Results Southern 100-C-9:1 (5 pages).

Constituent	J02FL0 01/20/05 18"spur (adjacent to 100-C-7)		J02HJ1 02/10/05 Between 100-C-7 and 1st spur line	
	ug/kg	Q	ug/kg	Q
Bis(2-ethylhexyl) phthalate	100	JB	53	JB
Butylbenzylphthalate	500	U	430	U
Carbazole	500	U	430	U
Chrysene	78	J	230	J
Di-n-butylphthalate	500	U	84	J
Di-n-octylphthalate	500	U	430	U
Dibenz[a,h]anthracene	500	U	37	J
Dibenzofuran	500	U	430	U
Diethylphthalate	500	U	430	U
Dimethyl phthalate	500	U	430	U
Fluoranthene	53	J	400	J
Fluorene	500	U	430	U
Hexachlorobenzene	500	U	430	U
Hexachlorobutadiene	500	U	430	U
Hexachlorocyclopentadiene	500	U	430	U
Hexachloroethane	500	U	430	U
Indeno(1,2,3-cd)pyrene	30	J	95	J
Isophorone	500	U	430	U
N-Nitroso-di-n-dipropylamine	500	U	430	U
N-Nitrosodiphenylamine	500	U	430	U
Naphthalene	500	U	430	U
Nitrobenzene	500	U	430	U
Pentachlorophenol	1200	U	1100	U
Phenanthrene	500	U	220	J
Phenol	500	U	430	U
Pyrene	48	J	370.955	J

APPENDIX B

**GRIDDED RADIOLOGICAL SURVEYS OF STOCKPILES AND
BOTTOM OF EXCAVATIONS**

Figure B-1. Radiological Survey Data from Excavation Stockpiles from the Northern 100-C-9:1 Shallow Zone.

Figure B-2. Radiological Survey Data from Bottom of Excavation of the Northern 100-C-9:1 Shallow Zone.

Figure B-3. Radiological Survey Data from Excavation Stockpiles from the Southern 100-C-9:1 Shallow Zone.

Figure B-4. Radiological Survey Data from Excavation Stockpiles from the Southern 100-C-9:1 Shallow Zone.

Figure B-5. Radiological Survey Data from Excavation Stockpiles from the Southern 100-C-9:1 Shallow Zone.

Figure B-6. Radiological Survey Data from Excavation Stockpiles from the Southern 100-C-9:1 Shallow Zone.

APPENDIX C

95% UCL CALCULATIONS

Note: This appendix contains the individual 95% UCL calculations for the northern and southern sections of 100-C-9:1. Sample data are presented following each calculation.

CALCULATION COVER SHEET

Project Title: 100-B/C Area Field Remediation Job No. 14655
 Area: 100-B/C
 Discipline: Environmental *Calc. No. 0100C-CA-V0025
 Subject: 100-C-9:1 (North) Field Cleanup Verification 95% UCL Calculations
 Computer Program: Excel Program No. Excel 2003

The attached calculations have been generated to document compliance with established cleanup levels. These documents should be used in conjunction with other relevant documents in the administrative record.

Committed Calculation ☒ Preliminary ☐ Superseded ☐ Voided ☐

Rev.	Sheet Numbers	Originator	Checker	Reviewer	Approval	Date
0	Cover = 1 Sheets = 9 Attn. 1 = 3 Total = 13	<i>J. M. Capron</i> 11/17/05 J. M. Capron	<i>T. M. Blakley</i> 11/17/05 T. M. Blakley	<i>L. M. Dittmer</i> 11/17/05 L. M. Dittmer	<i>D. N. Strom</i> D. N. Strom	11-17-05

SUMMARY OF REVISIONS

* Obtain calc no. from DIS

DE01437.03 (12/09/2004)

Washington Closure Hanford

CALCULATION SHEET

Originator J. M. Capron
 Project 100-B/C Area Field Remediation
 Subject 100-C-9:1 (North) Field Cleanup Verification 95% UCL Calculations

Date 11/17/05
 Job No. 14655

Calc. No. 01DOC-CA-V0025
 Checked T. M. Blakley

Rev. No. 0
 Date 11/17/05
 Sheet No. 1 of 9

Summary

- 1 Purpose:
 2 Calculate the 95% upper confidence limit (UCL) values to evaluate compliance with cleanup standards for the subject site. Also, perform the Washington Administrative Code (WAC) 173-340-
 3 740(7)(e) Model Toxics Control Act (MTC) 3-part test for nonradionuclide analytes and calculate the relative percent difference (RPD) for primary-duplicate sample pairs for each contaminant of
 4 concern (COC) and contaminant of potential concern (COPC), as necessary.
 5
 6 Table of Contents:
 7 Sheets 1 to 2 - Calculation Sheet Summary
 8 Sheets 3 to 4 - Calculation Sheet Shallow Zone Verification Data
 9 Sheet 5 - Calculation Sheet Duplicate Analysis
 10 Sheets 6 to 9 - Ecology Software (MTCStat) Results
 11 Attachment 1 - 100-C-9:1 Verification Sampling Results (3 sheets)
 12
 13
 14 Given/References:
 15 1) Sample Results (Attachment 1).
 16 2) Background values and remedial action goals (RAGs) are taken from DOE-RL (2005b), DOE-RL (2001), Ecology (1994), and Ecology (1996).
 17 3) DOE-RL, 2001, *Hanford Site Background: Part 1, Soil Background for Nonradioactive Analytes*, DOE/RL-92-24, Rev. 4, U.S. Department of Energy, Richland Operations Office,
 18 Richland, Washington.
 19 4) DOE-RL, 2005a, *100 Area Remedial Action Sampling and Analysis Plan (SAP)*, DOE/RL-96-22, Rev. 4, U.S. Department of Energy, Richland Operations Office, Richland, Washington.
 20 5) DOE-RL, 2005b, *Remedial Design Report/Remedial Action Work Plan for the 100 Area (RDR/RAWP)*, DOE/RL-96-17, Rev. 5, U.S. Department of Energy, Richland Operations
 21 Office, Richland, Washington.
 22 6) Ecology, 1992, *Statistical Guidance for Ecology Site Managers*, Publication #92-54, Washington Department of Ecology, Olympia, Washington.
 23 7) Ecology, 1993, *Statistical Guidance for Ecology Site Managers, Supplement S-6, Analyzing Site or Background Data with Below-detection Limit or Below-PQL Values (Censored*
 24 *Data Sets)*, Publication #92-54, Washington Department of Ecology, Olympia, Washington.
 25 8) Ecology, 1994, *Natural Background Soil Metals Concentrations in Washington State*, Publication #94-115, Washington State Department of Ecology, Olympia, Washington.
 26 9) Ecology, 1996, *Model Toxic Control Act Cleanup Levels and Risk Calculations (CLARC II)*, Publication #94-145, Washington State Department of Ecology, Olympia, Washington.
 27 10) EPA, 1994, *USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review*, EPA 540/R-94/013, U.S. Environmental Protection Agency,
 28 Washington, D.C.
 29 11) WAC 173-340, 1996, "Model Toxic Control Act - Cleanup," *Washington Administrative Code*.
 30
 31 Solution:
 32 Calculation methodology is described in Ecology Pub. #92-54 (Ecology 1992, 1993), below, and in the RDR/RAWP (DOE-RL 2005b). Use data from attached worksheets to perform the 95%
 33 UCL calculation for each analyte, the WAC 173-340-740(7)(e) 3-part test for nonradionuclides, and the RPD calculations for each COC/COPC. The hazard quotient and carcinogenic risk
 34 calculations are located in a separate calculation brief as an appendix to the Remaining Sites Verification Package (RSVP).
 35
 36 Calculation Description:
 37 The subject calculations were performed on data from soil verification samples from the subject waste site. The data were entered into an EXCEL 2003 spreadsheet and calculations performed
 38 by using the built-in spreadsheet functions and/or creating formulae within the cells. The statistical evaluation of data for use in accordance with the RDR/RAWP (DOE-RL 2005b) is documented
 39 by this calculation. Duplicate RPD results are used in evaluation of data quality within the RSVP for this site.
 40
 41 Methodology:
 42 For nonradioactive analytes with <50% of the data below detection limits and all radionuclide analytes, the statistical value calculated to evaluate the effectiveness of cleanup is the 95% UCL.
 43 For nonradioactive analytes with >50% of the data below detection limits, the maximum detected value for the data set is used instead of the 95% UCL. The evaluation of the portion of the data
 44 set below detection limits was performed by direct inspection of the attached sample results. All nonradionuclide data reported as being undetected are set to ½ the detection limit value for
 45 calculation of the statistics (Ecology 1993). No radionuclide COCs were identified for this site.
 46
 47 For the statistical evaluation of duplicate sample pairs, the samples are averaged before being included in the data set, after adjustments for censored data as described above.
 48
 49 For nonradionuclides, the WAC 173-340 statistical guidance suggests that a test for distributional form be performed on the data and the 95% UCL calculated on the appropriate distribution using
 50 Ecology software. For nonradionuclide small data sets (n < 10) and all radionuclide data sets, the calculations are performed assuming nonparametric distribution, so no tests for distribution are
 51 performed. For nonradionuclide data sets of ten or greater, as for the subject site, distributional testing is done using Ecology's MTCStat software (Ecology 1993).
 52
 53 The WAC 173-340-740(7)(e) 3-part test is performed for nonradionuclide analytes only and determines if:
 54 1) the 95% UCL exceeds the most stringent cleanup limit for each COC/COC,
 55 2) greater than 10% of the raw data exceed the most stringent cleanup limit for each COC/COC,
 56 3) the maximum value of the raw data set exceeds two times the most stringent cleanup limit for each COC/COC.
 57
 58 The RPD is calculated when both the primary value and the duplicate are above detection limits and are greater than 5 times the target detection limit (TDL). The TDL is a laboratory detection
 59 limit pre-determined for each analytical method, listed in Table II-1 of the SAP (DOE-RL 2005a). The RPD calculations use the following formula:
 60
$$RPD = \frac{|M - S|}{((M + S)/2)} \times 100$$

 61
 62 where, M = Main Sample Value S = Split (or duplicate) Sample Value
 63
 64 For quality assurance/quality control (QA/QC) split and duplicate RPD calculations, a value less than 30% indicates the data compare favorably. For regulatory spills, a threshold of 35% is used
 65 (EPA 1994). If the RPD is greater than 30% (or 35% for regulatory split data), further investigation regarding the usability of the data is performed. No split samples were collected for cleanup
 66 verification of the subject site. Additional discussion as necessary is provided in the data quality assessment section of the applicable RSVP.
 67
 68
 69
 70
 71
 72
 73
 74
 75
 76
 77
 78
 79
 80

Washington Closure Hanford

CALCULATION SHEET

Originator J. M. Casron *JMC*
 Project 100-B/C Area Field Remediation
 Subject 100-C-9:1 (North) Field Cleanup Verification 95% UCL Calculations

Date 11/17/05

Job No. 14655

Calc. No. 0100C-CA-V0025

Checked T. M. Blakley *TMB*

Rev. No. 0
 Date 11/17/05
 Sheet No. 12 of 9

Summary (continued)

Results:

The results presented in the summary tables that follow are for use in risk analysis and the RSVP for this site.

Results Summary			
Analyte	95% UCL ^a	Maximum ^b	Units
Antimony		0.47	mg/kg
Arsenic		2.7	mg/kg
Barium	68		mg/kg
Beryllium	0.33		mg/kg
Boron	0.8		mg/kg
Cadmium	0.14		mg/kg
Chromium (total)	8.9		mg/kg
Hexavalent Chromium	0.37		mg/kg
Cobalt	8.1		mg/kg
Copper	16.8		mg/kg
Lead	4.0		mg/kg
Manganese	318		mg/kg
Mercury	0.05		mg/kg
Molybdenum		0.42	mg/kg
Nickel	10.9		mg/kg
Selenium		0.47	mg/kg
Vanadium	46.7		mg/kg
Zinc	41.1		mg/kg

25 WAC 173-340-740(7)(e) Evaluation

All data sets meet the MTCA

27 WAC 3-Part Test for most stringent cleanup limit:

3-part test criteria when compared to the most stringent cleanup limits.

28 95% UCL > Cleanup Limit?

NO

29 > 10% above Cleanup Limit?

NO

30 Any sample > 2x Cleanup Limit?

NO

32 *For nonradionuclides, where ≤ 50% of a data set is censored (below detection limits), the 95% UCL value is used for a given analyte.

33 *Where > 50% of a data set is censored, the statistical value defaults to the maximum detected value in the data set (Attachment 1).

34 MTCA = Model Toxic Control Act

35 UCL = upper confidence level

36 WAC = Washington Administrative Code

Relative Percent Difference Results ^a - QA/QC Analysis	
Analyte	Duplicate Analysis
Barium	2.0%
Chromium (total)	7.7%
Copper	6.6%
Manganese	10%
Vanadium	10%
Zinc	7.5%

47 *Relative percent difference evaluation was not required for analytes not included in this table.

48 QA/QC = quality assurance/quality control

49

CALCULATION SHEET

Washington Closure Hanford

Originator J. M. Capron
Project 100-B/C Area Field Remediation
Subject 100-C-9:1 (North) Field Cleanup Verification 95% UCL Calculations

Date 11/17/05
Job No. 14655

Calc. No. 0100C-CA-V0025
Checked T. M. Blakley

Rev. No. 0
Date 11/17/05
Sheet No. 3 of 9

1 Shallow Zone Verification Data

Sampling Area	HEIS Number	Sample Date	Barium			Beryllium			Boron			Cadmium			Chromium (total)			Hexavalent Chromium			Cobalt		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
1	J03WX7	8/23/2005	64.4		0.009	0.24		0.009	0.89		0.21	0.05		0.04	7.5		0.06	0.20	U	0.20	5.2		0.06
Duplicate of J03WX7	J03X12	8/23/2005	63.1		0.009	0.27		0.009	0.88		0.21	0.05		0.04	8.1		0.06	0.29		0.20	6.5		0.06
2	J03WX8	8/23/2005	53.9		0.009	0.25		0.009	0.87		0.21	0.07		0.04	11.1		0.06	0.23		0.20	5.2		0.06
3	J03WX9	8/23/2005	74.1		0.009	0.31		0.009	0.40		0.21	0.11		0.04	9.9		0.06	0.57		0.20	6.2		0.06
4	J03WY0	8/23/2005	54.0		0.009	0.27		0.009	0.21	U	0.21	0.09		0.04	8.5		0.07	0.20	U	0.20	5.1		0.07
5	J03WY1	8/23/2005	65.9		0.009	0.30		0.009	0.61		0.21	0.18		0.11	9.6		0.07	0.20	U	0.20	6.0		0.07
6	J03WY2	8/23/2005	55.2		0.009	0.24		0.009	0.21	U	0.21	0.11		0.11	8.7		0.06	0.20	U	0.20	5.2		0.06
7	J03WY3	8/23/2005	70.5		0.009	0.32		0.009	0.59		0.21	0.12		0.11	9.4		0.06	0.20	U	0.20	6.4		0.06
8	J03WY4	8/23/2005	78.1		0.009	0.36		0.009	0.52		0.21	0.17		0.11	9.6		0.07	0.22		0.20	7.3		0.07
9	J03WY5	8/23/2005	61.0		0.009	0.25		0.009	0.21	U	0.21	0.13		0.11	9.2		0.06	1.30		0.20	5.2		0.06
10	J03WY6	8/23/2005	105		0.009	0.34		0.009	0.48		0.21	0.17		0.11	11.9		0.07	0.20	U	0.20	6.3		0.07
11	J03WY7	8/23/2005	52.6		0.009	0.28		0.009	0.21	U	0.21	0.11	U	0.11	3.4		0.06	0.25		0.20	8.6		0.06
12	J03WY8	8/23/2005	54.4		0.009	0.30		0.009	0.21	U	0.21	0.23		0.11	2.9		0.06	0.20	U	0.20	8.3		0.06
13	J03WY9	8/23/2005	63.2		0.009	0.35		0.009	0.92		0.21	0.20		0.11	9.0		0.06	0.21		0.20	8.8		0.06
14	J03X00	8/23/2005	66.6		0.009	0.36		0.009	0.65		0.21	0.18		0.11	7.7		0.06	0.30		0.20	10.4		0.06
15	J03X01	8/23/2005	47.8		0.009	0.24		0.009	0.21	U	0.21	0.16		0.11	4.9		0.06	0.20	U	0.20	5.9		0.06
16	J03X02	8/23/2005	52.5		0.009	0.24		0.009	0.21	U	0.21	0.13		0.11	5.8		0.06	0.24		0.20	5.3		0.06
17	J03X03	8/23/2005	80.2		0.009	0.39		0.009	1.2		0.21	0.13		0.04	6.0		0.06	0.27		0.20	10.2		0.06
18	J03X04	8/23/2005	60.9		0.009	0.36		0.009	1.0		0.21	0.12		0.04	6.1		0.06	0.86		0.20	9.4		0.06
19	J03X05	8/23/2005	69.0		0.009	0.38		0.009	0.94		0.21	0.12		0.04	6.4		0.06	0.21		0.20	8.7		0.06
20	J03X06	8/23/2005	62.5		0.009	0.34		0.009	1.1		0.21	0.12		0.04	8.7		0.06	0.20	U	0.20	9.6		0.06
21	J03X07	8/23/2005	58.6		0.009	0.35		0.009	1.1		0.21	0.04	U	0.04	5.2		0.06	0.20	U	0.20	9.4		0.06
22	J03X08	8/23/2005	55.8		0.009	0.33		0.009	1.4		0.21	0.08		0.04	5.6		0.06	0.20	U	0.20	8.3		0.06

28 Statistical Computation Input Data

Sampling Area	HEIS Number	Sample Date	Barium mg/kg	Beryllium mg/kg	Boron mg/kg	Cadmium mg/kg	Chromium (total) mg/kg	Hexavalent Chromium mg/kg	Cobalt mg/kg
1	J03WX7/J03X12	8/23/2005	63.8	0.26	0.89	0.05	7.8	0.20	5.9
2	J03WX8	8/23/2005	53.9	0.25	0.87	0.07	11.1	0.23	5.2
3	J03WX9	8/23/2005	74.1	0.31	0.40	0.11	9.9	0.57	6.2
4	J03WY0	8/23/2005	54.0	0.27	0.11	0.09	8.5	0.10	5.1
5	J03WY1	8/23/2005	65.9	0.30	0.61	0.18	9.6	0.10	6.0
6	J03WY2	8/23/2005	55.2	0.24	0.11	0.11	8.7	0.10	5.2
7	J03WY3	8/23/2005	70.5	0.32	0.59	0.12	9.4	0.10	6.4
8	J03WY4	8/23/2005	78.1	0.36	0.52	0.17	9.6	0.22	7.3
9	J03WY5	8/23/2005	61.0	0.25	0.11	0.13	9.2	1.30	5.2
10	J03WY6	8/23/2005	105	0.34	0.48	0.17	11.9	0.10	6.3
11	J03WY7	8/23/2005	52.6	0.28	0.11	0.055	3.4	0.25	8.6
12	J03WY8	8/23/2005	54.4	0.30	0.11	0.23	2.9	0.10	8.3
13	J03WY9	8/23/2005	63.2	0.35	0.92	0.20	9.0	0.21	8.8
14	J03X00	8/23/2005	66.6	0.36	0.65	0.18	7.7	0.30	10.4
15	J03X01	8/23/2005	47.8	0.24	0.11	0.16	4.9	0.10	5.9
16	J03X02	8/23/2005	52.5	0.24	0.11	0.13	5.8	0.24	5.3
17	J03X03	8/23/2005	80.2	0.39	1.2	0.13	6.0	0.27	10.2
18	J03X04	8/23/2005	60.9	0.36	1.0	0.12	6.1	0.86	9.4
19	J03X05	8/23/2005	69.0	0.38	0.94	0.12	6.4	0.21	8.7
20	J03X06	8/23/2005	62.5	0.34	1.1	0.12	8.7	0.10	9.6
21	J03X07	8/23/2005	58.6	0.35	1.1	0.02	5.2	0.10	9.4
22	J03X08	8/23/2005	55.8	0.33	1.4	0.08	5.6	0.10	8.3

54 Statistical Computations

	Barium	Beryllium	Boron	Cadmium	Chromium (total)	Hexavalent Chromium	Cobalt
Statistical value based on	Large data set (n ≥ 10), use MTCASat lognormal distribution.	Large data set (n ≥ 10), use MTCASat lognormal distribution.	Large data set (n ≥ 10), use MTCASat normal distribution.	Large data set (n ≥ 10), use MTCASat normal distribution.	Large data set (n ≥ 10), use MTCASat lognormal distribution.	Large data set (n ≥ 10), lognormal and normal distribution rejected, use Z-statistic.	Large data set (n ≥ 10), use MTCASat lognormal distribution.
N	22	22	22	22	22	22	22
% < Detection limit	0%	0%	32%	9%	0%	45%	0%
mean	64	0.31	0.6	0.12	7.6	0.27	7.3
standard deviation	13	0.05	0.4	0.05	2.4	0.29	1.8
95% UCL on mean	68	0.33	0.8	0.14	8.9	0.37	8.1
maximum value	105	0.39	1.4	0.23	11.9	1.3	10.4
Statistical value	68	0.33	0.8	0.14	8.9	0.37	8.1
Most Stringent Cleanup Limit for nonradionuclide and RAG type	132 BG/GW Protection	1.51 BG/GW & River Protection	320 GW Protection	0.81 BG/GW & River Protection	18.5 BG/GW & River Protection	2.0 River Protection	32 GW Protection
WAC 173-340 3-PART TEST							
95% UCL > Cleanup Limit?	NA	NA	NO	NA	NA	NO	NA
> 10% above Cleanup Limit?	NA	NA	NO	NA	NA	NO	NA
Any sample > 2X Cleanup Limit?	NA	NA	NO	NA	NA	NO	NA

70 WAC 173-340 Compliance?	YES	Because all values are below background (132 mg/kg), the MTCA 3-part test is not required.	Because all values are below background (1.51 mg/kg), the MTCA 3-part test is not required.	The data set meets the 3-part test criteria when compared to the most stringent cleanup limit.	Because all values are below background (0.81 mg/kg), the MTCA 3-part test is not required.	Because all values are below background (18.5 mg/kg), the MTCA 3-part test is not required.	The data set meets the 3-part test criteria when compared to the most stringent cleanup limit.	Because all values are below background (15.7 mg/kg), the MTCA 3-part test is not required.
----------------------------	-----	--	---	--	---	---	--	---

72 BG = background
73 GW = groundwater
74 HEIS = Hanford Environmental Information System
75 MTCA = Model Toxic Control Act
76 NA = not applicable
PQL = practical quantitation limit
Q = qualifier (J = estimate; U = undetected)
RAG = remedial action goal
U = undetected
WAC = Washington Administrative Code

Washington Closure Ha

1 Shallow Zone Verificati

2	Sampling	H
3	Area	Nu
4	1	J03
5	Duplicate of	J03
6	J03WX7	
7	2	J03
8	3	J03
9	4	J03
10	5	J03
11	6	J03
12	7	J03
13	8	J03
14	9	J03
15	10	J03
16	11	J03
17	12	J03
18	13	J03
19	14	J03
20	15	J03
21	16	J03
22	17	J03
23	18	J03
24	19	J03
25	20	J03
26	21	J03
27	22	J03

28 Statistical Computation

29	Sampling	H
30	Area	Nu
31	1	J03WX
32	2	J03
33	3	J03
34	4	J03
35	5	J03
36	6	J03
37	7	J03
38	8	J03
39	9	J03
40	10	J03
41	11	J03
42	12	J03
43	13	J03
44	14	J03
45	15	J03
46	16	J03
47	17	J03
48	18	J03
49	19	J03
50	20	J03
51	21	J03
52	22	J03

54 Statistical Computation

55	
56	
57	
58	
59	
60	
61	
62	
63	

Most Stringent Cleanu

64	
65	WAC 173-340 3-PART T
66	
67	
68	Any
69	

70 WAC 173-340 Compliar

71	
72	BG = background
73	GW = groundwater
74	HEIS = Hanford Environ
75	MTCA = Model Toxic Cc
76	NA = not applicable

CALCULATION SHEET

Washington Closure Hanford

Originator J. M. Capron
Project 100-B/C Area Field Remediation
Subject 100-C-9:1 (North) Field Cleanup Verification 95% UCL Calculations

Date 11/17/05
Job No. 14655

Calc. No. 0100C-CA-V0025
Checked T. M. Blakley

Rev. No. 0
Date 11/17/05
Sheet No. 5 of 9

1 Duplicate Analysis

Sampling Area	HEIS Number	Sample Date	Barium			Beryllium			Boron			Cadmium			Chromium (total)			Hexavalent Chromium			Cobalt		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
1	J03WX7	8/23/2005	64.4		0.009	0.24		0.009	0.89		0.21	0.05		0.04	7.5		0.06	0.20	U	0.20	5.2		0.06
Duplicate of J03WX7	J03X12	8/23/2005	63.1		0.009	0.27		0.009	0.88		0.21	0.05		0.04	8.1		0.06	0.29		0.20	6.5		0.06

6 Analysis:

(TDL)			2			0.5			2			0.5			1			0.5			2		
Duplicate Analysis	Both > PQL?		Yes (continue)			Yes (continue)			Yes (continue)			Yes (continue)			Yes (continue)			No-Stop (acceptable)			Yes (continue)		
	Both >5xTDL?		Yes (calc RPD)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			Yes (calc RPD)						No-Stop (acceptable)		
	RPD		2.0%												7.7%								

Sampling Area	HEIS Number	Sample Date	Copper			Lead			Manganese			Mercury			Nickel			Vanadium			Zinc		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
1	J03WX7	8/23/2005	13.1		0.12	3.4		0.26	279		0.02	0.01	U	0.01	10.1		0.12	28.8		0.05	29.4		0.06
Duplicate of J03WX7	J03X12	8/23/2005	14.0		0.12	3.0		0.26	307		0.02	0.02		0.01	11.0		0.12	31.9		0.05	31.7		0.06

17 Analysis:

(TDL)			1			5			5			0.2			4			2.5			1		
Duplicate Analysis	Both > PQL/MDA?		Yes (continue)			Yes (continue)			Yes (continue)			No-Stop (acceptable)			Yes (continue)			Yes (continue)			Yes (continue)		
	Both >5xTDL?		Yes (calc RPD)			No-Stop (acceptable)			Yes (calc RPD)						No-Stop (acceptable)			Yes (calc RPD)			Yes (calc RPD)		
	RPD		6.6%						10%									10%			7.5%		

22 HEIS = Hanford Environmental Information System
23 PQL = practical quantitation limit
24 Q = qualifier
25 RPD = relative percent difference
26 TDL = target detection limit
27 U = undetected

Washington Closure Hanford

CALCULATION SHEET

Originator J. M. Capron
Project 100-B/C Area Field Remediation
Subject 100-C-9-1 (North) Field Cleanup Verification 95% UCL Calculations

Date 11/17/05
Job No. 14655

Calc. No. 0100C-CA-V0025
Checked T. M. Blakey

Rev. No. 0
Date 4/19/05
Sheet No. 6 of 9

Ecology Software (MTCStat) Results

Barium 95% UCL Calculation						Beryllium 95% UCL Calculation					
DATA	ID					DATA	ID				
63.8	J03WX7/J03X12					0.26	J03WX7/J03X12				
63.9	J03WX8					0.25	J03WX8				
74.1	J03WX9	Number of samples		Uncensored values		0.31	J03WX9	Number of samples		Uncensored values	
54.0	J03WY0	Uncensored	22	Mean	64	0.27	J03WY0	Uncensored	22	Mean	0.31
65.9	J03WY1	Censored		Lognormal mean	64	0.30	J03WY1	Censored		Lognormal mean	0.31
55.2	J03WY2	Detection limit or PCL		Std. dev.	13	0.24	J03WY2	Detection limit or PCL		Std. dev.	0.05
70.6	J03WY3	Method detection limit		Median	82	0.32	J03WY3	Method detection limit		Median	0.32
78.1	J03WY4	TOTAL	22	Min.	47.8	0.36	J03WY4	TOTAL	22	Min.	0.24
61.0	J03WY5			Max.	105	0.26	J03WY5			Max.	0.39
105	J03WY6					0.34	J03WY6				
82.6	J03WY7					0.28	J03WY7				
54.4	J03WY8					0.30	J03WY8				
63.2	J03WY9	Lognormal distribution?		Normal distribution?		0.35	J03WY9	Lognormal distribution?		Normal distribution?	
65.0	J03X00	r-squared is:	0.921	r-squared is:	0.944	0.36	J03X00	r-squared is:	0.928	r-squared is:	0.938
47.8	J03X01	Recommendations:				0.34	J03X01	Recommendations:			
52.5	J03X02	Use lognormal distribution.				0.24	J03X02	Use lognormal distribution.			
60.2	J03X03					0.39	J03X03				
60.9	J03X04					0.36	J03X04				
69.0	J03X05	UCL (Land's method) is	66			0.38	J03X05	UCL (Land's method) is	0.33		
62.6	J03X06					0.34	J03X06				
59.8	J03X07					0.35	J03X07				
55.8	J03X08					0.33	J03X08				
Boron 95% UCL Calculation						Cadmium 95% UCL Calculation					
DATA	ID					DATA	ID				
0.89	J03WX7/J03X12					0.06	J03WX7/J03X12				
0.87	J03WX8					0.07	J03WX8				
0.40	J03WX9	Number of samples		Uncensored values		0.11	J03WX9	Number of samples		Uncensored values	
0.11	J03WY0	Uncensored	22	Mean	0.6	0.09	J03WY0	Uncensored	22	Mean	0.12
0.61	J03WY1	Censored		Lognormal mean	0.7	0.18	J03WY1	Censored		Lognormal mean	0.13
0.11	J03WY2	Detection limit or PCL		Std. dev.	0.4	0.11	J03WY2	Detection limit or PCL		Std. dev.	0.05
0.59	J03WY3	Method detection limit		Median	0.6	0.12	J03WY3	Method detection limit		Median	0.12
0.52	J03WY4	TOTAL	22	Min.	0.11	0.17	J03WY4	TOTAL	22	Min.	0.02
0.11	J03WY5			Max.	1.4	0.13	J03WY5			Max.	0.23
0.48	J03WY6					0.17	J03WY6				
0.11	J03WY7					0.055	J03WY7				
0.11	J03WY8					0.23	J03WY8				
0.82	J03WY9	Lognormal distribution?		Normal distribution?		0.20	J03WY9	Lognormal distribution?		Normal distribution?	
0.65	J03X00	r-squared is:	0.819	r-squared is:	0.816	0.18	J03X00	r-squared is:	0.859	r-squared is:	0.883
0.11	J03X01	Recommendations:				0.16	J03X01	Recommendations:			
0.11	J03X02	Use normal distribution.				0.13	J03X02	Use normal distribution.			
1.2	J03X03					0.13	J03X03				
1.0	J03X04					0.12	J03X04				
0.04	J03X05	UCL (based on t-statistic) is	0.8			0.12	J03X05	UCL (based on t-statistic) is	0.14		
1.1	J03X06					0.12	J03X06				
1.1	J03X07					0.02	J03X07				
1.4	J03X08					0.05	J03X08				

Washington Closure Hanford

CALCULATION SHEET

Originator J. M. Capron *JMC*
 Project 100-B/C Area Field Remediation
 Subject 100-C-9:1 (North) Field Cleanup Verification 95% UCL Calculations

Date 11/17/05
 Job No. 14655

Calc. No. 0100C-CA-V0025
 Checked T. M. Blakley *TMB*

Rev. No. 0
 Date 11/17/05
 Sheet No. 7 of 9

Ecology Software (MTCStat) Results

DATA	ID	Chromium 95% UCL Calculation				DATA	ID	Hexavalent Chromium 95% UCL Calculation			
7.8	J03WX7/J03X12					0.20	J03WX7/J03X12				
11.1	J03WX8					0.23	J03WX8				
9.9	J03WX9	Number of samples		Uncensored values		0.57	J03WX9	Number of samples		Uncensored values	
8.5	J03WY0	Uncensored	22	Mean	7.6	0.10	J03WY0	Uncensored	22	Mean	0.27
9.6	J03WY1	Censored		Lognormal mean	7.7	0.10	J03WY1	Censored		Lognormal mean	0.25
8.7	J03WY2	Detection limit or PQL		Std. devn.	2.4	0.10	J03WY2	Detection limit or PQL		Std. devn.	0.29
9.4	J03WY3	Method detection limit		Median	8.2	0.10	J03WY3	Method detection limit		Median	0.20
9.6	J03WY4	TOTAL	22	Min.	2.9	0.22	J03WY4	TOTAL	22	Min.	0.10
9.2	J03WY5			Max.	11.9	1.30	J03WY5			Max.	1.30
11.9	J03WY6					0.10	J03WY6				
3.4	J03WY7					0.26	J03WY7				
2.9	J03WY8					0.10	J03WY8				
9.0	J03WY9	Lognormal distribution?		Normal distribution?		0.21	J03WY9	Lognormal distribution?		Normal distribution?	
7.7	J03X00	r-squared is:	0.913	r-squared is:	0.970	0.30	J03X00	r-squared is:	0.814	r-squared is:	0.590
4.9	J03X01	Recommendations:				0.10	J03X01	Recommendations:			
5.8	J03X02	Use lognormal distribution.				0.24	J03X02	Reject BOTH lognormal and normal distributions. See Statistics Guidance.			
6.0	J03X03					0.27	J03X03				
6.1	J03X04					0.86	J03X04				
6.4	J03X05	UCL (Land's method) is	8.9			0.21	J03X05	UCL (based on Z-statistic) is	0.37		
8.7	J03X06					0.10	J03X06				
5.2	J03X07					0.10	J03X07				
5.6	J03X08					0.10	J03X08				
DATA	ID	Cobalt 95% UCL Calculation				DATA	ID	Copper 95% UCL Calculation			
5.9	J03WX7/J03X12					13.6	J03WX7/J03X12				
5.2	J03WX8					16.1	J03WX8				
6.2	J03WX9	Number of samples		Uncensored values		17.2	J03WX9	Number of samples		Uncensored values	
5.1	J03WY0	Uncensored	22	Mean	7.3	13.0	J03WY0	Uncensored	22	Mean	16.9
6.0	J03WY1	Censored		Lognormal mean	7.4	15.9	J03WY1	Censored		Lognormal mean	15.9
5.2	J03WY2	Detection limit or PQL		Std. devn.	1.8	12.8	J03WY2	Detection limit or PQL		Std. devn.	2.2
6.4	J03WY3	Method detection limit		Median	6.9	15.1	J03WY3	Method detection limit		Median	16.0
7.3	J03WY4	TOTAL	22	Min.	5.1	17.8	J03WY4	TOTAL	22	Min.	11.4
6.2	J03WY5			Max.	10.4	11.4	J03WY5			Max.	19.5
6.3	J03WY6					17.6	J03WY6				
8.6	J03WY7					15.1	J03WY7				
8.3	J03WY8					15.6	J03WY8				
8.8	J03WY9	Lognormal distribution?		Normal distribution?		15.1	J03WY9	Lognormal distribution?		Normal distribution?	
10.4	J03X00	r-squared is:	0.914	r-squared is:	0.911	16.6	J03X00	r-squared is:	0.955	r-squared is:	0.970
5.9	J03X01	Recommendations:				13.7	J03X01	Recommendations:			
5.3	J03X02	Use lognormal distribution.				13.2	J03X02	Use lognormal distribution.			
10.2	J03X03					19.5	J03X03				
9.4	J03X04					18.6	J03X04				
8.7	J03X05	UCL (Land's method) is	8.1			18.1	J03X05	UCL (Land's method) is	16.8		
9.6	J03X06					18.5	J03X06				
9.4	J03X07					18.1	J03X07				
8.3	J03X08					17.0	J03X08				

Washington Closure Hanford

Originator J. M. Capron *JMC*
Project 100-B/C Area Field Remediation
Subject 100-C-9:1 (North) Field Cleanup Verification 95% UCL Calculations

CALCULATION SHEET

Date 11/17/96
Job No. 14655

Calc. No. 0100C-CA-V0025
Checked T. M. Blakley *TMB*

Rev. No. 0
Date 4/7/05
Sheet No. 8 of 9

Ecology Software (MTCASat) Results

DATA	ID	Lead 95% UCL Calculation			
3.2	J03WX7/J03X12				
3.6	J03WX8				
6.9	J03WX9				
3.3	J03WY0	Number of samples	22	Uncensored values	
3.7	J03WY1	Uncensored		Mean	3.6
3.0	J03WY2	Censored		Lognormal mean	3.9
4.2	J03WY3	Detection limit or PQL		Std. dev.	1.2
4.8	J03WY4	Method detection limit		Median	3.6
2.2	J03WY5	TOTAL	22	Min.	0.4
5.1	J03WY6			Max.	6.9
0.40	J03WY7				
2.8	J03WY8				
4.4	J03WY9	Lognormal distribution?		Normal distribution?	
3.8	J03X00	r-squared is:	0.649	r-squared is:	0.907
2.8	J03X01	Recommendations:			
2.6	J03X02	Use lognormal distribution.			
3.7	J03X03				
3.0	J03X04				
3.7	J03X05	UCL (Land's method) is	4.0		
4.7	J03X06				
3.2	J03X07				
3.5	J03X08				

DATA	ID	Mercury 95% UCL Calculation			
0.01	J03WX7/J03X12				
0.005	J03WX8				
0.04	J03WX9				
0.01	J03WY0	Number of samples	22	Uncensored values	
0.02	J03WY1	Uncensored		Mean	0.03
0.01	J03WY2	Censored		Lognormal mean	0.03
0.01	J03WY3	Detection limit or PQL		Std. dev.	0.03
0.005	J03WY4	Method detection limit		Median	0.01
0.12	J03WY5	TOTAL	22	Min.	0.005
0.005	J03WY6			Max.	0.12
0.01	J03WY7				
0.01	J03WY8				
0.02	J03WY9	Lognormal distribution?		Normal distribution?	
0.08	J03X00	r-squared is:	0.923	r-squared is:	0.744
0.05	J03X01	Recommendations:			
0.04	J03X02	Use lognormal distribution.			
0.03	J03X03				
0.01	J03X04				
0.03	J03X05	UCL (Land's method) is	0.05		
0.005	J03X06				
0.01	J03X07				
0.01	J03X08				

DATA	ID	Manganese 95% UCL Calculation			
293	J03WX7/J03X12				
262	J03WX8				
268	J03WX9				
245	J03WY0	Number of samples	22	Uncensored values	
277	J03WY1	Uncensored		Mean	290
242	J03WY2	Censored		Lognormal mean	299
285	J03WY3	Detection limit or PQL		Std. dev.	47
330	J03WY4	Method detection limit		Median	295
239	J03WY5	TOTAL	22	Min.	213
208	J03WY6			Max.	375
287	J03WY7				
286	J03WY8				
307	J03WY9	Lognormal distribution?		Normal distribution?	
375	J03X00	r-squared is:	0.967	r-squared is:	0.973
308	J03X01	Recommendations:			
213	J03X02	Use lognormal distribution.			
367	J03X03				
319	J03X04				
317	J03X05	UCL (Land's method) is	318		
356	J03X06				
359	J03X07				
335	J03X08				

DATA	ID	Nickel 95% UCL Calculation			
10.6	J03WX7/J03X12				
12.9	J03WX8				
11.1	J03WX9				
10.7	J03WY0	Number of samples	22	Uncensored values	
10.7	J03WY1	Uncensored		Mean	9.9
11.7	J03WY2	Censored		Lognormal mean	9.9
12.2	J03WY3	Detection limit or PQL		Std. dev.	2.8
12.4	J03WY4	Method detection limit		Median	10.2
7.8	J03WY5	TOTAL	22	Min.	5.4
14.9	J03WY6			Max.	14.9
6.5	J03WY7				
5.4	J03WY8				
11.2	J03WY9	Lognormal distribution?		Normal distribution?	
9.9	J03X00	r-squared is:	0.970	r-squared is:	0.985
7.4	J03X01	Recommendations:			
7.2	J03X02	Use lognormal distribution.			
9.7	J03X03				
7.7	J03X04				
8.6	J03X05	UCL (Land's method) is	10.9		
8.6	J03X06				
11.5	J03X07				
9.5	J03X08				

Washington Closure Hanford

CALCULATION SHEET

Originator J. M. Capron *JMC*

Date 11/17/05

Calc. No. 0100C-CA-V0025

Rev. No. 0

Project 100-B/C Area Field Remediation

Job No. 14655

Checked T. M. Blakley *TMB*

Date 11/17/05

Subject 100-C-9:1 (North) Field Cleanup Verification 95% UCL Calculations

Sheet No. 9 of 9

Ecology Software (MTCStat) Results

DATA	ID	Vanadium 95% UCL Calculation				DATA	ID	Zinc 95% UCL Calculation			
30.4	J03WX7/J03X12					30.6	J03WX7/J03X12				
24.4	J03WX8					29.5	J03WX8				
32.7	J03WX9	Number of samples		Uncensored values		37.8	J03WX9	Number of samples		Uncensored values	
20.9	J03WY0	Uncensored	22	Mean	41.2	30.1	J03WY0	Uncensored	22	Mean	38.1
31.4	J03WY1	Censored		Lognormal mean	41.8	33.1	J03WY1	Censored		Lognormal mean	38.1
34.0	J03WY2	Detection limit or PCL		Std. dev.	12.5	31.2	J03WY2	Detection limit or PCL		Std. dev.	7.2
37.1	J03WY3	Method detection limit		Median	37.6	36.0	J03WY3	Method detection limit		Median	37.9
38.0	J03WY4	TOTAL	22	Min.	34.2	37.9	J03WY4	TOTAL	22	Min.	25.9
27.7	J03WY5			Max.	59.3	25.9	J03WY5			Max.	51.6
27.9	J03WY6					37.6	J03WY6				
55.5	J03WY7					41.0	J03WY7				
55.1	J03WY8					42.0	J03WY8				
49.8	J03WY9	Lognormal distribution?		Normal distribution?		45.0	J03WY9	Lognormal distribution?		Normal distribution?	
55.1	J03X00	r-squared is:	0.827	r-squared is:	0.912	51.6	J03X00	r-squared is:	0.951	r-squared is:	0.858
24.2	J03X01	Recommendations:				29.8	J03X01	Recommendations:			
32.9	J03X02	Use lognormal distribution.				29.7	J03X02	Use lognormal distribution.			
59.3	J03X03					47.5	J03X03				
55.9	J03X04					43.4	J03X04				
47.6	J03X05	UCL (Land's method) is	46.7			43.3	J03X05	UCL (Land's method) is	41.1		
52.7	J03X06					45.4	J03X06				
55.3	J03X07					46.6	J03X07				
43.2	J03X08					42.2	J03X08				

Attachment 1. 100-C-9:1 (North) Verification Sampling Results.

Sample Location	HEIS Number	Sample Date	Antimony			Arsenic			Barium			Beryllium			Boron			Cadmium			Chromium (total)		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
1	J03WX7	8/23/05	0.27	U	0.27	2.9	U	2.9	64.4		0.009	0.24		0.009	0.89		0.21	0.05		0.04	7.5		0.06
Duplicate of J03WX7	J03X12	8/23/05	0.27	U	0.27	2.7		0.42	63.1		0.009	0.27		0.009	0.88		0.21	0.05		0.04	8.1		0.06
2	J03WX8	8/23/05	0.47	J	0.28	3.7	U	3.7	53.9		0.009	0.25		0.009	0.87		0.21	0.07		0.04	11.1		0.06
3	J03WX9	8/23/05	0.28	U	0.28	3.7	U	3.7	74.1		0.009	0.31		0.009	0.40		0.21	0.11		0.04	9.9		0.06
4	J03WY0	8/23/05	0.28	U	0.28	2.5	U	2.5	54.0		0.009	0.27		0.009	0.21	U	0.21	0.09		0.04	8.5		0.07
5	J03WY1	8/23/05	0.28	U	0.28	3.9	U	3.9	65.9		0.009	0.30		0.009	0.61		0.21	0.18		0.11	9.6		0.07
6	J03WY2	8/23/05	0.27	U	0.27	2.4	U	2.4	55.2		0.009	0.24		0.009	0.21	U	0.21	0.11		0.11	8.7		0.06
7	J03WY3	8/23/05	0.27	U	0.27	2.9	U	2.9	70.5		0.009	0.32		0.009	0.59		0.21	0.12		0.11	9.4		0.06
8	J03WY4	8/23/05	0.28	U	0.28	4.7	U	4.7	78.1		0.009	0.36		0.009	0.52		0.21	0.17		0.11	9.6		0.07
9	J03WY5	8/23/05	0.28	U	0.28	2.2	U	2.2	61.0		0.009	0.25		0.009	0.21	U	0.21	0.13		0.11	9.2		0.06
10	J03WY6	8/23/05	0.28	U	0.28	4.9	U	4.9	105		0.009	0.34		0.009	0.48		0.21	0.17		0.11	11.9		0.07
11	J03WY7	8/23/05	0.27	U	0.27	2.2	U	2.2	52.6		0.009	0.28		0.009	0.21	U	0.21	0.11	U	0.11	3.4		0.06
12	J03WY8	8/23/05	0.28	U	0.28	1.9	U	1.9	54.4		0.009	0.30		0.009	0.21	U	0.21	0.23		0.11	2.9		0.06
13	J03WY9	8/23/05	0.27	U	0.27	3.4	U	3.4	63.2		0.009	0.35		0.009	0.92		0.21	0.20		0.11	9.0		0.06
14	J03X00	8/23/05	0.27	U	0.27	3.4	U	3.4	66.6		0.009	0.36		0.009	0.65		0.21	0.18		0.11	7.7		0.06
15	J03X01	8/23/05	0.28	U	0.28	2.5	U	2.5	47.8		0.009	0.24		0.009	0.21	U	0.21	0.16		0.11	4.9		0.06
16	J03X02	8/23/05	0.28	U	0.28	2.4	U	2.4	52.5		0.009	0.24		0.009	0.21	U	0.21	0.13		0.11	5.8		0.06
17	J03X03	8/23/05	0.27	U	0.27	2.6	U	2.6	80.2		0.009	0.39		0.009	1.2		0.21	0.13		0.04	6.0		0.06
18	J03X04	8/23/05	0.41	J	0.28	3.5	U	3.5	60.9		0.009	0.36		0.009	1.0		0.21	0.12		0.04	6.1		0.06
19	J03X05	8/23/05	0.28	U	0.28	2.5	U	2.5	69.0		0.009	0.38		0.009	0.94		0.21	0.12		0.04	6.4		0.06
20	J03X06	8/23/05	0.27	U	0.27	2.8	U	2.8	62.5		0.009	0.34		0.009	1.1		0.21	0.12		0.04	8.7		0.06
21	J03X07	8/23/05	0.27	U	0.27	2.4		0.43	58.6		0.009	0.35		0.009	1.1		0.21	0.04	U	0.04	5.2		0.06
22	J03X08	8/23/05	0.27	U	0.27	2.6		0.42	55.8		0.009	0.33		0.009	1.4		0.21	0.08		0.04	5.6		0.06
North suspect BCL	J03X09	8/23/05	0.27	U	0.27	4.9		0.43	79.7		0.009	0.33		0.009	1.5		0.21	0.09		0.04	9.8		0.06
Middle suspect BCL	J03X10	8/23/05	0.27	U	0.27	2.4		0.42	53.5		0.009	0.29		0.009	1.5		0.20	0.04		0.04	5.8		0.06
Duplicate of J03X10	J03X13	8/23/05	0.27	U	0.27	2.6		0.42	60.6		0.009	0.31		0.009	1.6		0.21	0.07		0.04	6.4		0.06
South suspect BCL	J03X11	8/23/05	0.27	U	0.27	3.3		0.43	75.1		0.009	0.36		0.009	2.4		0.21	0.09		0.04	9.7		0.06
Equipment Blank	J03X14	8/23/05	0.27		0.27	0.42	U	0.42	1.3		0.009	0.05		0.009	0.58		0.21	0.04	U	0.04	0.10		0.06

Note: The following abbreviations apply to all Attachment 1 tables.

BCL = below contaminant level (stockpiles)

HEIS = Hanford Environmental Information System

J = estimate

PQL = practical quantitation limit

Q = qualifier

U = undetected

Attachment	I	Sheet No.	1 of 3
Originator	J. M. Capron <i>JMC</i>	Date	11/17/05
Checked	T. M. Blakley <i>TMB</i>	Date	11/17/05
Calc. No.	0100C-CA-V0025	Rev. No.	0

Attachment 1. 100-C-9:1 (North) Verification Sampling Results.

Sample Location	HEIS Number	Sample Date	Hexavalent Chromium			Cobalt			Copper			Lead			Manganese			Mercury			Molybdenum		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
1	J03WX7	8/23/05	0.20	U	0.20	5.2		0.06	13.1		0.12	3.4		0.26	279		0.02	0.01	U	0.01	0.29	UJ	0.29
Duplicate of J03WX7	J03X12	8/23/05	0.29		0.20	6.5		0.06	14.0		0.12	3.0		0.26	307		0.02	0.02		0.01	0.42		0.16
2	J03WX8	8/23/05	0.23		0.20	5.2		0.06	16.1		0.12	3.6		0.27	262		0.02	0.01	U	0.01	0.28	UJ	0.28
3	J03WX9	8/23/05	0.57		0.20	6.2		0.06	17.2		0.12	6.9		0.27	288		0.02	0.04		0.01	0.33	UJ	0.33
4	J03WY0	8/23/05	0.20	U	0.20	5.1		0.07	13.0		0.12	3.3		0.27	245		0.02	0.02	U	0.02	0.32	UJ	0.32
5	J03WY1	8/23/05	0.20	U	0.20	6.0		0.07	15.9		0.12	3.7		0.81	277		0.02	0.02		0.01	0.36	UJ	0.36
6	J03WY2	8/23/05	0.20	U	0.20	5.2		0.06	12.8		0.12	3.0		0.80	242		0.02	0.01	U	0.01	0.24	UJ	0.24
7	J03WY3	8/23/05	0.20	U	0.20	6.4		0.06	15.1		0.12	4.2		0.80	295		0.02	0.02	U	0.02	0.24	UJ	0.24
8	J03WY4	8/23/05	0.22		0.20	7.3		0.07	17.8		0.12	4.8		0.81	330		0.02	0.01	U	0.01	0.28	UJ	0.28
9	J03WY5	8/23/05	1.30		0.20	5.2		0.06	11.4		0.12	2.2		0.81	229		0.02	0.12		0.01	0.18	UJ	0.18
10	J03WY6	8/23/05	0.20	U	0.20	6.3		0.07	17.6		0.12	5.1		0.81	298		0.02	0.01	U	0.01	0.37	UJ	0.37
11	J03WY7	8/23/05	0.25		0.20	8.6		0.06	15.1		0.12	1.7	UJ	1.7	297		0.02	0.01	U	0.01	0.41	UJ	0.41
12	J03WY8	8/23/05	0.20	U	0.20	8.3		0.06	15.6		0.12	2.9		0.80	286		0.02	0.02	U	0.02	0.47	UJ	0.47
13	J03WY9	8/23/05	0.21		0.20	8.8		0.06	15.1		0.12	4.4		0.78	357		0.02	0.02		0.01	0.53	UJ	0.53
14	J03X00	8/23/05	0.30		0.20	10.4		0.06	16.6		0.12	3.8		0.78	375		0.02	0.08		0.01	0.63	UJ	0.63
15	J03X01	8/23/05	0.20	U	0.20	5.9		0.06	13.7		0.12	2.8		0.80	238		0.02	0.06		0.01	0.35	UJ	0.35
16	J03X02	8/23/05	0.24		0.20	5.3		0.06	13.2		0.12	2.6		0.80	213		0.02	0.05		0.01	0.37	UJ	0.37
17	J03X03	8/23/05	0.27		0.20	10.2		0.06	19.5		0.12	3.7		0.26	367		0.02	0.04		0.01	0.53	UJ	0.53
18	J03X04	8/23/05	0.86		0.20	9.4		0.06	18.6		0.12	3.0		0.27	319		0.02	0.03		0.01	0.51	UJ	0.51
19	J03X05	8/23/05	0.21		0.20	8.7		0.06	18.1		0.12	3.7		0.27	317		0.02	0.02	U	0.02	0.30	UJ	0.30
20	J03X06	8/23/05	0.20	U	0.20	9.6		0.06	18.5		0.12	4.7		0.27	356		0.02	0.03		0.01	0.52	UJ	0.52
21	J03X07	8/23/05	0.20	U	0.20	9.4		0.06	18.1		0.12	3.2		0.27	359		0.02	0.01	U	0.01	0.37		0.16
22	J03X08	8/23/05	0.20	U	0.20	8.3		0.06	17.0		0.12	3.5		0.26	325		0.02	0.02	U	0.02	0.41		0.16
North suspect BCL	J03X09	8/23/05	0.22		0.20	6.8		0.06	17.0		0.12	5.4		0.26	302		0.02	0.03		0.01	0.33		0.16
Middle suspect BCL	J03X10	8/23/05	0.20	U	0.20	7.3		0.06	14.1		0.12	3.8		0.26	280		0.02	0.01	U	0.01	0.42		0.16
Duplicate of J03X10	J03X13	8/23/05	0.30		0.20	7.2		0.06	15.5		0.12	4.1		0.26	304		0.02	0.01	U	0.01	0.37		0.16
South suspect BCL	J03X11	8/23/05	0.20	U	0.20	7.6		0.06	17.0		0.12	6.3		0.26	329		0.02	0.03		0.01	0.35		0.16
Equipment Blank	J03X14	8/23/05				0.09		0.06	0.12	U	0.12	0.40		0.26	10.3		0.02	0.02	U	0.02	0.16	U	0.16

Attachment	I	Sheet No.	2 of 3
Originator	J. M. Capron	Date	11/17/05
Checked	T. M. Blakley	Date	
Calc. No.	0100C-CA-V0025	Rev. No.	0

Attachment 1. 100-C-9:1 (North) Verification Sampling Results.

Sample Location	HEIS Number	Sample Date	Nickel			Selenium			Silver			Vanadium			Zinc		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
1	J03WX7	8/23/05	10.1		0.12	0.39	U	0.39	0.07	U	0.07	28.8		0.05	29.4		0.06
Duplicate of J03WX7	J03X12	8/23/05	11.0		0.12	0.47		0.38	0.07	U	0.07	31.9		0.05	31.7		0.06
2	J03WX8	8/23/05	12.9		0.12	0.40	U	0.40	0.07	U	0.07	24.4		0.06	29.5		0.06
3	J03WX9	8/23/05	11.1		0.12	0.40	U	0.40	0.07	U	0.07	32.7		0.06	37.8		0.06
4	J03WY0	8/23/05	10.7		0.12	0.40	U	0.40	0.07	U	0.07	29.9		0.06	30.1		0.07
5	J03WY1	8/23/05	10.7		0.12	0.40	U	0.40	0.07	U	0.07	31.4		0.06	33.1		0.07
6	J03WY2	8/23/05	11.7		0.12	0.39	U	0.39	0.07	U	0.07	34.0		0.05	31.2		0.06
7	J03WY3	8/23/05	12.2		0.12	0.39	U	0.39	0.07	U	0.07	37.1		0.05	36.0		0.06
8	J03WY4	8/23/05	12.4		0.12	0.40	U	0.40	0.07	U	0.07	38.0		0.06	37.9		0.07
9	J03WY5	8/23/05	7.8		0.12	0.40	U	0.40	0.07	U	0.07	27.7		0.06	25.9		0.06
10	J03WY6	8/23/05	14.9		0.12	0.40	U	0.40	0.07	U	0.07	27.9		0.06	37.8		0.07
11	J03WY7	8/23/05	6.5		0.12	0.39	U	0.39	0.07	U	0.07	56.8		0.05	41.0		0.06
12	J03WY8	8/23/05	5.4		0.12	0.39	U	0.39	0.07	U	0.07	58.1		0.06	42.0		0.06
13	J03WY9	8/23/05	11.2		0.12	0.39	U	0.39	0.13	UJ	0.13	48.8		0.05	45.0		0.06
14	J03X00	8/23/05	9.9		0.12	0.39	U	0.39	0.07	U	0.07	58.1		0.05	51.6		0.06
15	J03X01	8/23/05	7.4		0.12	0.40	U	0.40	0.07	U	0.07	24.2		0.06	29.8		0.06
16	J03X02	8/23/05	7.2		0.12	0.40	U	0.40	0.07	U	0.07	32.9		0.06	29.7		0.06
17	J03X03	8/23/05	9.7		0.12	0.47	UJ	0.47	0.07	U	0.07	59.3		0.05	47.5		0.06
18	J03X04	8/23/05	7.7		0.12	0.46	UJ	0.46	0.11	UJ	0.11	53.9		0.06	43.4		0.06
19	J03X05	8/23/05	8.6		0.12	0.40	U	0.40	0.07	U	0.07	47.6		0.06	43.3		0.06
20	J03X06	8/23/05	8.8		0.12	0.41	UJ	0.41	0.07	UJ	0.07	52.7		0.05	45.4		0.06
21	J03X07	8/23/05	11.5		0.12	0.39	U	0.39	0.07	U	0.07	56.3		0.05	46.6		0.06
22	J03X08	8/23/05	8.5		0.12	0.39	U	0.39	0.07	U	0.07	43.2		0.05	42.2		0.06
North suspect BCL	J03X09	8/23/05	12.5		0.12	0.46		0.39	0.07	U	0.07	32.8		0.05	38.7		0.06
Middle suspect BCL	J03X10	8/23/05	8.5		0.12	0.38	U	0.38	0.07	U	0.07	37.6		0.05	35.8		0.06
Duplicate of J03X10	J03X13	8/23/05	8.8		0.12	0.39	U	0.39	0.07	U	0.07	35.3		0.05	36.8		0.06
South suspect BCL	J03X11	8/23/05	10.0		0.12	0.39	U	0.39	0.07	U	0.07	41.7		0.05	43.0		0.06
Equipment Blank	J03X14	8/23/05	0.17		0.12	0.39	U	0.39	0.07	U	0.07	0.27		0.05	2.5		0.06

Attachment	I	Sheet No.	3 of 3
Originator	J. M. Capron	Date	11/17/05
Checked	T. M. Blakley	Date	
Calc. No.	0100C-CA-V0025	Rev. No.	0

CALCULATION COVER SHEET

Project Title: 100-B/C Remaining Pipes and Sewers Field Remediation **Job No.** 14655
Area: 100-B/C
Discipline: Environmental ***Calc. No.** 0100C-CA-V0029
Subject: 100-C-9:1 (South) Waste Site Cleanup Verification 95% UCL Calculations
Computer Program: Excel **Program No.** Excel 2003

The attached calculations have been generated to document compliance with established cleanup levels. These calculations should be used in conjunction with other relevant documents in the administrative record.

Committed Calculation ☒ Preliminary ☐ Superseded ☐ Voided ☐

Rev.	Sheet Numbers	Originator	Checker	Reviewer	Approval	Date
0	Cover = 1 Sheets = 13 Attn. 1 = 6 Total = 20	11/13/06 J. M. Capron	11/16/06 T. M. Blakley	N/A	11-21-06 D. N. Strom	11-21-06
SUMMARY OF REVISIONS						

WCH-DE-018 (9/01/2006)

* Obtain Calc. No. from R&DC and Form from Intranet

CALCULATION SHEET

Washington Closure Hanford

Originator J. M. Capron *JMC* Date 11/13/06 Calc. No. 0100C-CA-V0029 Rev. No. 0
 Project 100-B/C Remaining Pipes and Sewers Field Remediation Job No. 14655 Checked T. M. Blakley *TMB* Date 11/14/06
 Subject 100-C-9:1 (South) Waste Site Cleanup Verification 95% UCL Calculations Sheet No. 1 of 13

Summary**Purpose:**

Calculate the 95% upper confidence limit (UCL) values to evaluate compliance with cleanup standards for the subject site. Also, perform the *Washington Administrative Code* (WAC) 173-340-740(7)(e) 3-part test for each nonradioactive contaminant of concern (COC) and contaminant of potential concern (COPC) and calculate the relative percent difference (RPD) for primary-duplicate sample pairs, as necessary.

Table of Contents:

Sheets 1 to 3 - Summary
 Sheets 4 to 7 - 100-C-9:1 (South) Remediation Footprint Shallow Zone Verification Data Evaluation
 Sheets 8 to 11 - Ecology Software (MTCASat) Results
 Sheets 12 to 13 - Duplicate Analysis
 Attachment 1 - 100-C-9:1 (South) Verification Sampling Results (6 sheets)

Given/References:

- 1) Sample Results (Attachment 1).
- 2) Background values and remedial action goals (RAGs) are taken from DOE-RL (2005b), DOE-RL (2001), and Ecology (2005).
- 3) DOE-RL, 2001, *Hanford Site Background: Part 1, Soil Background for Nonradioactive Analytes*, DOE/RL-92-24, Rev. 4, U.S. Department of Energy, Richland Operations Office, Richland, Washington.
- 4) DOE-RL, 2005a, *100 Area Remedial Action Sampling and Analysis Plan* (SAP), DOE/RL-96-22, Rev. 4, U.S. Department of Energy, Richland Operations Office, Richland, Washington.
- 5) DOE-RL, 2005b, *Remedial Design Report/Remedial Action Work Plan for the 100 Area* (RDR/RAWP), DOE/RL-96-17, Rev. 5, U.S. Department of Energy, Richland Operations Office, Richland, Washington.
- 6) Ecology, 1992, *Statistical Guidance for Ecology Site Managers*, Publication #92-54, Washington Department of Ecology, Olympia, Washington.
- 7) Ecology, 1993, *Statistical Guidance for Ecology Site Managers, Supplement S-6, Analyzing Site or Background Data with Below-detection Limit or Below-PQL Values (Censored Data Sets)*, Publication #92-54, Washington Department of Ecology, Olympia, Washington.
- 8) Ecology, 2005, *Cleanup Levels and Risk Calculations (CLARC) Database*, Washington State Department of Ecology, Olympia, Washington, <<https://fortress.wa.gov/ecy/clarc/CLARCHome.aspx>>.
- 9) EPA, 1994, *USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review*, EPA 540/R-94/013, U.S. Environmental Protection Agency, Washington, D.C.
- 10) WAC 173-340, 1996, "Model Toxic Control Act - Cleanup," *Washington Administrative Code*.

Solution:

Calculation methodology is described in Ecology Pub. #92-54 (Ecology 1992, 1993), below, and in the RDR/RAWP (DOE-RL 2005b). Use data from attached worksheets to perform the 95% UCL calculation for each analyte, the WAC 173-340-740(7)(e) 3-part test for nonradionuclides, and the RPD calculations, as required. The hazard quotient and carcinogenic risk calculations are located in a separate calculation brief as an appendix to the Remaining Sites Verification Package (RSVP).

Calculation Description:

The subject calculations were performed on data from soil verification samples from the subject waste site. The data were entered into an EXCEL 2003 spreadsheet and calculations performed by using the built-in spreadsheet functions and/or creating formulae within the cells. The statistical evaluation of data for use in accordance with the RDR/RAWP (DOE-RL 2005b) is documented by this calculation. Duplicate RPD results are used in evaluation of data quality within the RSVP for this site.

Methodology:

For nonradioactive analytes with $\leq 50\%$ of the data below detection limits and all detected radionuclide analytes, the statistical value calculated to evaluate the effectiveness of cleanup is the 95% UCL. For nonradioactive analytes with $> 50\%$ of the data below detection limits, the maximum detected value for the data set is used instead of the 95% UCL. The 95% UCL is not calculated for data sets with no reported detections. The evaluation of the portion of each analyte's data set below detection limits was performed by direct inspection of the attached sample results, and no further calculations were performed for those data sets where $> 50\%$ of the data was below detection limits. The 95% UCL values were not calculated for aluminum, calcium, iron, lithium, magnesium, phosphorus, potassium, silicon, sodium, strontium, thallium, tin, titanium, uranium, and zirconium as these constituents are not considered site COCs/COPCs.

CALCULATION SHEET

Washington Closure Hanford

Originator J. M. Capron *JMC* Date 11/13/06 Calc. No. 0100C-CA-V0029 Rev. No. 0
 Project 100-B/C Remaining Pipes and Sewers Field Remediation Job No. 14655 Checked T. M. Blakley *TMB* Date 11/14/06
 Subject 100-C-9:1 (South) Waste Site Cleanup Verification 95% UCL Calculations Sheet No. 2 of 13

Summary (continued)

- 1 All nonradionuclide data reported as being undetected are set to ½ the detection limit value for calculation of the statistics (Ecology
 2 1993). For radionuclide data, calculation of the statistics is done using the reported value. In cases where the laboratory does not
 3 report a value below the minimum detectable activity (MDA), half of the MDA is used in the calculation. For the statistical
 4 evaluation of duplicate sample pairs, the samples are averaged before being included in the data set, after adjustments for
 5 censored data as described above.
 6
 7 For nonradionuclides, the WAC 173-340 statistical guidance suggests that a test for distributional form be performed on the data
 8 and the 95% UCL calculated on the appropriate distribution using Ecology software. For nonradionuclide small data sets (n < 10)
 9 and all radionuclide data sets, the calculations are performed assuming nonparametric distribution, so no tests for distribution are
 10 performed. For nonradionuclide data sets of ten or greater, as for the subject site, distributional testing and calculation of the 95%
 11 UCL is done using Ecology's MTCASat software (Ecology 1993). Due to differences in addressing censored data between the
 12 RDR/RAWP (DOE-RL 2005b) and MTCASat coding and due to a limitation in the MTCASat coding (no direct capability to
 13 address variable quantitation limits within a data set), substitutions for censored data are performed before software input and the
 14 resulting input set treated as uncensored.
 15
 16 The WAC 173-340-740(7)(e) 3-part test is performed for nonradionuclide analytes only and determines if:
 17 1) the 95% UCL exceeds the most stringent cleanup limit for each COPC/COC,
 18 2) greater than 10% of the raw data exceed the most stringent cleanup limit for each COPC/COC,
 19 3) the maximum value of the raw data set exceeds two times the most stringent cleanup limit for each COPC/COC.
 20
 21 The WAC 173-340-740(7)(e) 3-part test is not performed for COPCs/COCs where the statistical value defaults to the maximum
 22 value in the data set. Instead, direct comparison of the maximum value against site RAGs (within the RSVP) is used as the
 23 compliance basis.
 24
 25 The RPD values are evaluated for all analytes detected in a primary-duplicate or primary-split sample pair for the purposes of data
 26 quality assessment within the RSVP. The RPD is calculated when both the primary value and the duplicate value for a given
 27 analyte are above detection limits and are greater than 5 times the target detection limit (TDL). The TDL is a laboratory detection
 28 limit pre-determined for each analytical method, listed in Table II-1 of the SAP (DOE-RL 2005a). The RPD calculations use the
 29 following formula:
 30
 31
$$RPD = [|M-S| / ((M+S)/2)] * 100$$

 32
 33 where, M = main sample value S = split (or duplicate) sample value
 34
 35 For quality assurance/quality control (QA/QC) split and duplicate RPD calculations, a value less than 30% indicates the data
 36 compare favorably. For regulatory splits, a threshold of 35% is used (EPA 1994). If the RPD is greater than 30% (or 35% for
 37 regulatory split data), further investigation regarding the usability of the data is performed. As a matter of good practice, when an
 38 analyte is detected in the primary or duplicate sample, but was quantified at less than 5 times the TDL in one or both samples, an
 39 additional parameter is evaluated. In this case, if the difference between the primary and duplicate results exceeds a control limit
 40 of 2 times the TDL, further assessment regarding the usability of the data is performed. No split samples were collected for
 41 cleanup verification of the subject site. Additional discussion is provided in the data quality assessment section of the applicable
 42 RSVP, as necessary.
 43
 44 In addition to the statistical samples collected from the remediation footprint at the subject site, multi-aliquot samples were collected
 45 from stockpiled overburden and below-cleanup-level material. Statistical methodology is not applicable to non-statistical sampling,
 46 and direct evaluation of detected values within this decision unit will be used as the compliance basis. These maximum detected
 47 values are presented in the results summary for use in the RSVP.
 48
 49
 50
 51
 52

CALCULATION SHEET

Washington Closure HanfordOriginator J. M. Capron *JMC* Date 11/13/06 Job No. 14655

Calc. No. 0100C-CA-V0029

Rev. No. 0

Project 100-B/C Remaining Pipes and Sewers Field Remediation

Checked T. M. Blakley *TMB*

Date 11/16/06

Subject 100-C-9:1 (South) Waste Site Cleanup Verification 95% UCL Calculations

Sheet No. 8 of 13

1 Summary (continued)

2 Results:

3 The results presented in the summary tables that follow are for use in risk analysis and the RSVP for this site.

5 Results Summary - Remediation Footprint

Analyte	95% UCL ^a	Maximum ^b	Units
Antimony		0.62	mg/kg
Arsenic	5.0		mg/kg
Barium	75.9		mg/kg
Beryllium	0.40		mg/kg
Boron	1.0		mg/kg
Cadmium		0.26	mg/kg
Chromium	15.9		mg/kg
Cobalt	9.7		mg/kg
Copper	18.0		mg/kg
Hexavalent chromium		1.8	mg/kg
Lead	6.4		mg/kg
Manganese	400		mg/kg
Mercury	22.7		mg/kg
Molybdenum		0.32	mg/kg
Nickel	12.8		mg/kg
Vanadium	48.9		mg/kg
Zinc	48.2		mg/kg

24 WAC 173-340-740(7)(e) Evaluation

26 WAC 173-340 3-Part Test for most stringent RAG:

27 95% UCL > Cleanup Limit? YES

28 > 10% above Cleanup Limit? YES

29 Any sample > 2x Cleanup Limit? YES

Because of the "yes" answers to the WAC 173-340 3-part test for chromium and mercury, additional evaluation of the attainment of cleanup criteria will be performed.

30 ^aFor nonradionuclides, where ≤ 50% of a data set is censored (below detection limits), the 95% UCL value is used for a given analyte.31 ^bFor nonradionuclides, where > 50% of a data set is censored, the statistical value defaults to the maximum detected value in the data set (Attachment 1).

32 RAG = remedial action goal

WAC = Washington Administrative Code

33 UCL = upper confidence level

35 Relative Percent Difference Results^a - QA/QC Analysis

Analyte	Sample Node 2 Duplicate Analysis ^b	Sample Node 5 Duplicate Analysis ^b
Aluminum	15%	4.6%
Barium	14%	2.1%
Calcium	7.4%	1.2%
Chromium	11%	0%
Copper	3.6%	1.4%
Iron	8.8%	4.0%
Magnesium	5.5%	4.2%
Manganese	14%	3.2%
Phosphorus	1.4%	2.5%
Silicon	22%	2.0%
Strontium	6.3%	2.4%
Titanium	8.2%	1.2%
Vanadium	12%	0.86%
Zinc	2.5%	3.1%
Zirconium	17%	7.5%

52 ^aRelative percent difference evaluation was not required for analytes not included in this table.53 ^bThe significance of relative percent difference values are discussed within the RSVP for the subject site.

54 QA/QC = quality assurance/quality control

55 RSVP = remaining sites verification package

Results Summary - Overburden/BCL Stockpiles

Analyte	Maximum ^a	Units
Arsenic	3.1	mg/kg
Barium	62.6	mg/kg
Beryllium	0.38	mg/kg
Boron	1.8	mg/kg
Cadmium	0.25	mg/kg
Chromium	9.8	mg/kg
Cobalt	9.0	mg/kg
Copper	15.7	mg/kg
Hexavalent chromium	0.27	mg/kg
Lead	6.0	mg/kg
Manganese	356	mg/kg
Mercury	0.06	mg/kg
Molybdenum	0.29	mg/kg
Nickel	12.0	mg/kg
Vanadium	54.6	mg/kg
Zinc	42.4	mg/kg

^aVerification sampling of the overburden/BCL stockpiles was based on multi-aliquot, rather than statistical, sampling.
BCL = below cleanup levels

Washington Closure Hanford

CALCULATION SHEET

Originator J. M. Capron
Project 100-B/C Remaining Pipes and Sewers Field Remediation
Subject 100-C-9:1 (South) Waste Site Cleanup Verification 95% UCL Calculations

Date 11/13/06
Job No. 14655

Calc. No. 0100C-CA-V0029
Checked T. M. Blakley

Rev. No. 0
Date 11/16/06
Sheet No. 4 of 13

1 100-C-9:1 (South) Remediaton Footprint Verification Data

Sample Node	Sample Number	Sample Date	Arsenic			Barium			Beryllium			Boron			Chromium			Cobalt			Copper		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
1	J12XV3	7/27/06	3.3		0.56	46.9		0.06	0.22		0.06	0.66	U	0.66	6.1		0.36	7.1		0.39	14.2		0.33
2	J12XV4	7/27/06	2.9		0.56	81.4		0.06	0.33		0.06	1.5		0.66	8.5		0.36	8.0		0.39	14.1		0.33
Duplicate of J12XV4	J12XY3	7/27/06	2.5		0.60	70.6	C	0.02	0.33		0.06	1.6		0.24	9.5		0.13	8.4		0.14	13.6		0.12
3	J12XV5	7/27/06	3.4		0.56	63.6		0.05	0.28		0.05	0.66	U	0.66	10.8		0.36	7.2		0.38	15.0		0.33
4	J12XV6	7/27/06	4.7		0.57	84.6		0.06	0.37		0.06	2.2		0.67	10.2		0.37	7.9		0.39	17.3		0.34
5	J12XV7	7/27/06	3.9		0.57	78.4		0.06	0.32		0.06	1.1		0.67	12.5		0.36	7.3		0.39	14.5		0.33
Duplicate of J12XV7	J12XY4	7/27/06	3.2		0.59	76.8	C	0.02	0.33		0.06	1.4		0.23	12.5		0.13	7.7		0.13	14.7		0.12
6	J12XV8	7/27/06	3.0		0.57	86.6		0.06	0.30		0.06	0.67	U	0.67	4.4		0.36	9.2		0.39	16.2		0.33
7	J12XV9	7/27/06	3.0		0.57	64.5		0.06	0.34		0.06	0.93		0.67	10.0		0.36	7.7		0.39	14.0		0.33
8	J12XW0	7/27/06	3.7		0.57	62.8		0.06	0.33		0.06	1.7		0.67	8.3		0.36	8.4		0.39	17.3		0.33
9	J12XW1	7/27/06	4.8		0.56	83.3		0.06	0.37		0.06	0.96		0.66	15.4		0.36	7.6		0.39	15.9		0.33
10	J12XW2	7/27/06	4.1		0.57	52.8		0.06	0.31		0.06	0.67	U	0.67	8.1		0.36	8.2		0.39	16.2		0.33
11	J12XW3	7/27/06	4.1		0.56	71.0		0.06	0.31		0.06	0.66	U	0.66	12.4		0.36	7.2		0.39	14.8		0.33
12	J12XW4	7/27/06	4.7		0.57	85.2		0.06	0.36		0.06	0.67	U	0.67	16.9		0.36	7.6		0.39	15.9		0.34
13	J12XW5	7/27/06	9.1		0.56	101		0.06	0.47		0.06	0.66	U	0.66	11.4		0.36	9.5		0.39	21.1		0.33
14	J12XW6	7/27/06	8.1		0.55	57.2		0.05	0.47		0.05	0.65	U	0.65	12.7		0.35	10.1		0.38	20.8		0.33
15	J12XW7	7/27/06	6.7		0.57	72.4		0.06	0.38		0.06	0.68	U	0.68	60.6		0.37	9.9		0.39	17.0		0.34
16	J12XW8	7/27/06	6.5		0.56	62.9		0.06	0.39		0.06	0.66	U	0.66	13.4		0.36	9.2		0.39	19.6		0.33
17	J12XW9	7/27/06	4.5		0.56	57.6		0.06	0.40		0.06	0.66	U	0.66	8.6		0.36	10.3		0.39	19.0		0.33
18	J12XX0	7/27/06	3.7		0.59	61.6	C	0.02	0.55		0.06	0.83		0.23	9.0		0.13	12.3		0.13	21.1		0.12
19	J12XX1	7/27/06	3.3		0.59	102	C	0.02	0.48		0.06	1.5		0.23	6.6		0.13	12.5		0.14	19.7		0.12
20	J12XX2	7/27/06	4.3		0.59	64.3	C	0.02	0.43		0.06	1.0		0.23	10.0		0.13	11.9		0.14	20.7		0.12
21	J12XX3	7/27/06	2.8		0.58	59.5	C	0.02	0.35		0.06	1.4		0.23	7.1		0.12	8.5		0.13	16.5		0.11
22	J12XX4	7/27/06	2.8		0.58	68.0	C	0.02	0.38		0.06	0.86		0.23	6.9		0.12	11.3		0.13	16.8		0.11
23	J12XX5	7/27/06	2.9		0.59	52.3	C	0.02	0.35		0.06	1.1		0.23	7.5		0.13	9.7		0.14	16.4		0.12

29 Statistical Computation Input Data

Sample Node	Sample Number	Sample Date	Arsenic mg/kg		Barium mg/kg		Beryllium mg/kg		Boron mg/kg		Chromium mg/kg		Cobalt mg/kg		Copper mg/kg	
1	J12XV3	7/27/2006	3.3		46.9		0.22		0.33		6.1		7.1		14.2	
2	J12XV4/J12XY3	7/27/2006	2.7		76.0		0.33		1.6		9.0		8.2		13.9	
3	J12XV5	7/27/2006	3.4		63.6		0.28		0.33		10.8		7.2		15.0	
4	J12XV6	7/27/2006	4.7		84.6		0.37		2.2		10.2		7.9		17.3	
5	J12XV7/J12XY4	7/27/2006	3.6		77.6		0.33		1.3		12.5		7.5		14.6	
6	J12XV8	7/27/2006	3.0		86.6		0.30		0.34		4.4		9.2		16.2	
7	J12XV9	7/27/2006	3.0		64.5		0.34		0.93		10.0		7.7		14.0	
8	J12XW0	7/27/2006	3.7		62.8		0.33		1.7		8.3		8.4		17.3	
9	J12XW1	7/27/2006	4.8		83.3		0.37		0.96		15.4		7.6		15.9	
10	J12XW2	7/27/2006	4.1		52.8		0.31		0.34		8.1		8.2		16.2	
11	J12XW3	7/27/2006	4.1		71.0		0.31		0.33		12.4		7.2		14.8	
12	J12XW4	7/27/2006	4.7		85.2		0.36		0.34		16.9		7.6		15.9	
13	J12XW5	7/27/2006	9.1		101		0.47		0.33		11.4		9.5		21.1	
14	J12XW6	7/27/2006	8.1		57.2		0.47		0.33		12.7		10.1		20.8	
15	J12XW7	7/27/2006	6.7		72.4		0.38		0.34		60.6		9.9		17.0	
16	J12XW8	7/27/2006	6.5		62.9		0.39		0.33		13.4		9.2		19.6	
17	J12XW9	7/27/2006	4.5		57.6		0.40		0.33		8.6		10.3		19.0	
18	J12XX0	7/27/2006	3.7		61.6		0.55		0.83		9.0		12.3		21.1	
19	J12XX1	7/27/2006	3.3		102		0.48		1.5		6.6		12.5		19.7	
20	J12XX2	7/27/2006	4.3		64.3		0.43		1.0		10.0		11.9		20.7	
21	J12XX3	7/27/2006	2.8		59.5		0.35		1.4		7.1		8.5		16.5	
22	J12XX4	7/27/2006	2.8		68.0		0.38		0.86		6.9		11.3		16.8	
23	J12XX5	7/27/2006	2.9		52.3		0.35		1.1		7.5		9.7		16.4	

55 C = method blank contamination

56 PQL = practical quantitation limit

Q = qualifier

U = undetected

CALCULATION SHEET

Washington Closure Hanford

Originator J. M. Capron
Project 100-B/C Remaining Pipes and Sewers Field Remediation
Subject 100-C-9:1 (South) Waste Site Cleanup Verification 95% UCL Calculations

Date 11/13/06
Job No. 14655

Calc. No. 0100C-CA-V0029
Checked T. M. Blakley

Rev. No. 0
Date 11/16/06
Sheet No. 5 of 13

1 100-C-9:1 (South) Remediation Footprint Verification Data Statistical Computations

2		Arsenic	Barium	Beryllium	Boron	Chromium	Cobalt	Copper	
	95% UCL value based on	Large data set (n ≥ 10), use MTCASat lognormal distribution.	Large data set (n ≥ 10), use MTCASat lognormal distribution.	Large data set (n ≥ 10), use MTCASat lognormal distribution.	Large data set (n ≥ 10), lognormal and normal distribution rejected, use z-statistic.	Large data set (n ≥ 10), lognormal and normal distribution rejected, use z-statistic.	Large data set (n ≥ 10), use MTCASat lognormal distribution.	Large data set (n ≥ 10), use MTCASat lognormal distribution.	
3	N	23	23	23	23	23	23	23	
4	% < Detection limit	0%	0%	0%	48%	0%	0%	0%	
5	Mean	4.3	70.2	0.37	0.8	12.1	9.1	17.1	
6	Standard deviation	1.7	14.8	0.07	0.6	11.0	1.7	2.4	
7	95% UCL on mean	5.0	75.9	0.40	1.0	15.9	9.7	18.0	
8	Maximum detected value	9.1	102	0.55	2.2	60.6	12.5	21.1	
9	Statistical value	5.0	75.9	0.40	1.0	15.9	9.7	18.0	
10	Most Stringent Cleanup Limit for nonradionuclide and RAG type	Direct Exposure/GW & River Protection 20	BG/GW Protection 132	BG/GW & River Protection 1.51	GW Protection 320	BG/GW & River Protection 18.5	GW Protection 32	BG/River Protection 22.0	
11	WAC 173-340 3-PART TEST								
12	95% UCL > Cleanup Limit?	NO	NA	NA	NO	NO	NA	NA	
13	> 10% above Cleanup Limit?	NO	NA	NA	NO	NO	NA	NA	
14	Any sample > 2X Cleanup Limit?	NO	NA	NA	NO	YES	NA	NA	
15	WAC 173-340 Compliance?	Further assessment required	The data set meets the 3-part test criteria when compared to the most stringent cleanup limit.	Because all values are below background (132 mg/kg), the WAC 173-340 3-part test is not required.	Because all values are below background (1.51 mg/kg), the WAC 173-340 3-part test is not required.	The data set meets the 3-part test criteria when compared to the most stringent cleanup limit.	Because of the "yes" answer to the 3-part test, a detailed assessment using RESRAD will be performed. The data set meets the 3-part test criteria when compared to the direct exposure cleanup level.	Because all values are below background (15.7 mg/kg), the WAC 173-340 3-part test is not required.	Because all values are below background (22.0 mg/kg), the WAC 173-340 3-part test is not required.
16									

17 BG = background
18 GW = groundwater
19 NA = not applicable

RAG = remedial action goal
UCL = upper confidence limit
WAC = Washington Administrative Code

Washington Closure Hanford

Originator J. M. Capron

Project 100-B/C Remaining Pipes and Sewers Field Remediation

Subject 100-C-9:1 (South) Waste Site Cleanup Verification 95% UCL Calculations

Date 11/13/06

Job No. 14655

Calc. No. 0100C-CA-V0029

Checked T. M. Blakley

Rev. No. 0

Date 11/14/06

Sheet No. 6 of 13

CALCULATION SHEET

100-C-9:1 (South) Remediation Footprint Verification Data (continued)																					
	Sample Node	Sample Number	Sample Date	Lead			Manganese			Mercury			Nickel			Vanadium			Zinc		
				mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
2	1	J12XV3	7/27/06	5.5		0.86	277		0.08	0.01	U	0.01	7.9		0.66	37.6		0.25	37.1		0.44
3	2	J12XV4	7/27/06	5.3		0.85	411		0.08	0.01	U	0.01	10.1		0.66	38.8		0.25	40.8		0.44
4	Duplicate of J12XV4	J12XY3	7/27/06	4.3		0.91	358		0.03	0.02	U	0.02	11.0		0.24	43.6		0.09	39.8		0.16
5		3	J12XV5	7/27/06	5.2		0.85	292		0.08	0.01	U	0.01	12.6		0.66	37.1		0.25	40.8	
6	4	J12XV6	7/27/06	5.6		0.87	333		0.08	0.02	U	0.02	11.4		0.67	40.4		0.25	46.9		0.45
7	5	J12XV7	7/27/06	7.8		0.86	311		0.08	0.03		0.01	13.3		0.67	34.9		0.25	43.0		0.44
8	Duplicate of J12XV7	J12XY4	7/27/06	6.5		0.90	321		0.03	0.02		0.01	14.2		0.23	35.2		0.09	41.7		0.15
9		6	J12XV8	7/27/06	3.8		0.86	379		0.08	0.12		0.01	8.4		0.67	42.8		0.25	42.8	
10	7	J12XV9	7/27/06	5.8		0.86	336		0.08	0.11		0.01	10.1		0.67	39.2		0.25	39.6		0.45
11	8	J12XW0	7/27/06	6.0		0.86	356		0.08	0.02	U	0.02	12.0		0.67	44.8		0.25	56.4		0.45
12	9	J12XW1	7/27/06	6.6		0.85	327		0.08	0.01	U	0.01	16.4		0.66	34.2		0.25	46.9		0.44
13	10	J12XW2	7/27/06	5.1		0.86	334		0.08	0.02	U	0.02	11.5		0.67	43.3		0.25	42.3		0.45
14	11	J12XW3	7/27/06	6.0		0.86	303		0.08	0.01	U	0.01	13.6		0.66	33.8		0.25	42.2		0.44
15	12	J12XW4	7/27/06	6.1		0.87	311		0.08	0.07		0.01	17.0		0.67	37.1		0.25	46.9		0.45
16	13	J12XW5	7/27/06	10.7		0.85	432		0.08	0.89		0.01	13.2		0.66	39.5		0.25	51.2		0.44
17	14	J12XW6	7/27/06	9.5		0.85	457		0.08	2.6		0.05	15.1		0.65	37.4		0.25	52.3		0.44
18	15	J12XW7	7/27/06	5.0		0.87	437		0.08	0.49		0.01	10.8		0.68	51.7		0.25	49.5		0.45
19	16	J12XW8	7/27/06	7.6		0.85	393		0.08	8.8		0.15	11.7		0.66	40.1		0.25	46.7		0.44
20	17	J12XW9	7/27/06	6.0		0.86	388		0.08	0.06		0.02	11.7		0.66	36.9		0.25	46.0		0.44
21	18	J12XX0	7/27/06	4.8		0.90	454		0.03	4.3		0.08	11.0		0.23	77.0		0.09	57.9		0.15
22	19	J12XX1	7/27/06	4.6		0.90	497		0.03	0.14		0.01	11.6		0.23	65.3		0.09	51.6		0.16
23	20	J12XX2	7/27/06	5.1		0.90	449		0.03	3.5		0.08	12.8		0.23	60.5		0.09	52.9		0.16
24	21	J12XX3	7/27/06	4.3		0.88	351		0.03	0.01	U	0.01	9.6		0.23	44.7		0.08	38.8		0.15
25	22	J12XX4	7/27/06	3.1		0.89	467		0.03	0.05		0.02	12.1		0.23	62.3		0.09	45.5		0.15
26	23	J12XX5	7/27/06	3.5		0.90	358		0.03	0.57		0.01	9.2		0.23	52.6		0.09	44.0		0.16
29 Statistical Computation Input Data																					
	Sample Node	Sample Number	Sample Date	Lead mg/kg			Manganese mg/kg			Mercury mg/kg			Nickel mg/kg			Vanadium mg/kg			Zinc mg/kg		
30	1	J12XV3	7/27/2006	5.5			277			0.005			7.9			37.6			37.1		
31	2	J12XV4/J12XY3	7/27/2006	4.8			385			0.008			10.6			41.2			40.3		
32	3	J12XV5	7/27/2006	5.2			292			0.005			12.6			37.1			40.8		
33	4	J12XV6	7/27/2006	5.6			333			0.01			11.4			40.4			46.9		
34	5	J12XV7/J12XY4	7/27/2006	7.2			316			0.03			13.8			35.1			42.4		
35	6	J12XV8	7/27/2006	3.8			379			0.12			8.4			42.8			42.8		
36	7	J12XV9	7/27/2006	5.8			336			0.11			10.1			39.2			39.6		
37	8	J12XW0	7/27/2006	6.0			356			0.01			12.0			44.8			56.4		
38	9	J12XW1	7/27/2006	6.6			327			0.005			16.4			34.2			46.9		
39	10	J12XW2	7/27/2006	5.1			334			0.01			11.5			43.3			42.3		
40	11	J12XW3	7/27/2006	6.0			303			0.005			13.6			33.8			42.2		
41	12	J12XW4	7/27/2006	6.1			311			0.07			17.0			37.1			46.9		
42	13	J12XW5	7/27/2006	10.7			432			0.89			13.2			39.5			51.2		
43	14	J12XW6	7/27/2006	9.5			457			2.6			15.1			37.4			52.3		
44	15	J12XW7	7/27/2006	5.0			437			0.49			10.8			51.7			49.5		
45	16	J12XW8	7/27/2006	7.6			393			8.8			11.7			40.1			46.7		
46	17	J12XW9	7/27/2006	6.0			388			0.06			11.7			36.9			46.0		
47	18	J12XX0	7/27/2006	4.8			454			4.3			11.0			77.0			57.9		
48	19	J12XX1	7/27/2006	4.6			497			0.14			11.6			65.3			51.6		
49	20	J12XX2	7/27/2006	5.1			449			3.5			12.8			60.5			52.9		
50	21	J12XX3	7/27/2006	4.3			351			0.005			9.6			44.7			38.8		
51	22	J12XX4	7/27/2006	3.1			467			0.05			12.1			62.3			45.5		
52	23	J12XX5	7/27/2006	3.5			358			0.57			9.2			52.6			44.0		
55 PQL = practical quantitation limit																					
56 Q = qualifier																					
U = undetected																					

CALCULATION SHEET

Washington Closure Hanford

Originator J. M. Capron
Project 100-B/C Remaining Pipes and Sewers Field Remediation
Subject 100-C-9:1 (South) Waste Site Cleanup Verification 95% UCL Calculations

Date 11/13/06
Job No. 14655

Calc. No. 0100C-CA-V0029
Checked T. M. Blakley

Rev. No. 0
Date 11/16/06
Sheet No. 7 of 13

100-C-9:1 (South) Remediation Footprint Verification Data Statistical Computations (continued)

2		Lead	Manganese		Mercury		Nickel		Vanadium		Zinc			
3		95% UCL value based on	Large data set (n ≥ 10), use MTCASat lognormal distribution.		Large data set (n ≥ 10), use MTCASat lognormal distribution.		Large data set (n ≥ 10), use MTCASat lognormal distribution.		Large data set (n ≥ 10), lognormal and normal distribution rejected, use z-statistic.		Large data set (n ≥ 10), use MTCASat lognormal distribution.			
4	N	23		23		23		23		23		23		
5	% < Detection limit	0%		0%		39%		0%		0%		0%		
6	Mean	5.7		375		0.9		11.9		45.0		46.1		
7	Standard deviation	1.8		63		2.1		2.3		11.4		5.6		
8	95% UCL on mean	6.4		400		22.7		12.8		48.9		48.2		
9	Maximum detected value	10.7		497		8.8		17.0		77.0		57.9		
0	Statistical value	6.4		400		22.7		12.8		48.9		48.2		
1	Most Stringent Cleanup Limit for nonradionuclide and RAG type	BG/GW & River Protection 10.2		BG/GW & River Protection 512		BG/GW & River Protection 0.33		BG/GW Protection 19.1		BG/GW Protection 85.1		BG/River Protection 67.8		
2	WAC 173-340 3-PART TEST													
3	95% UCL > Cleanup Limit?	NO		NA		YES		NA		NA		NA		
4	> 10% above Cleanup Limit?	NO		NA		YES		NA		NA		NA		
5	Any sample > 2X Cleanup Limit?	NO		NA		YES		NA		NA		NA		
6	WAC 173-340 Compliance?	Further assessment required	The data set meets the 3-part test criteria when compared to the most stringent cleanup limit.		Because all values are below background (512 mg/kg), the WAC 173-340 3-part test is not required.		Because of the "yes" answers to the 3-part test, a detailed assessment using RESRAD will be performed. The data set meets the 3-part test criteria when compared to the direct exposure cleanup level.		Because all values are below background (19.1 mg/kg), the WAC 173-340 3-part test is not required.		Because all values are below background (85.1 mg/kg), the WAC 173-340 3-part test is not required.		Because all values are below background (67.8 mg/kg), the WAC 173-340 3-part test is not required.	

17 BG = background
18 GW = groundwater
19 NA = not applicable
RAG = remedial action goal
UCL = upper confidence limit
WAC = Washington Administrative Code

CALCULATION SHEET

Washington Closure Hanford

Originator J. M. Capron *JMC*

Project 100-B/C Remaining Pipes and Sewers Field Remediation

Subject 100-C-9:1 (South) Waste Site Cleanup Verification 95% UCL Calculations

Date 11/13/06

Job No. 14655

Calc. No. 0100C-CA-V0029

Checked T. M. Blakley *TMB*

Rev. No. 0

Date 4/16/08

Sheet No. 8 of 13

Ecology Software (MTCStat) Results

DATA	ID	Arsenic 95% UCL Calculation				DATA	ID	Barium 95% UCL Calculation			
3.3	J12XV3					46.9	J12XV3				
2.7	J12XV4/J12XY3					76.0	J12XV4/J12XY3				
3.4	J12XV5	Number of samples		Uncensored values		63.6	J12XV5	Number of samples		Uncensored values	
4.7	J12XV6	Uncensored	23	Mean	4.3	84.6	J12XV6	Uncensored	23	Mean	70.2
3.6	J12XV7/J12XY4	Censored		Lognormal mean	4.3	77.6	J12XV7/J12XY4	Censored		Lognormal mean	70.2
3.0	J12XV8	Detection limit or PQL		Std. devn.	1.7	86.6	J12XV8	Detection limit or PQL		Std. devn.	14.8
3.0	J12XV9	Method detection limit		Median	3.7	64.5	J12XV9	Method detection limit		Median	64.5
3.7	J12XW0	TOTAL	23	Min.	2.7	62.8	J12XW0	TOTAL	23	Min.	46.9
4.8	J12XW1			Max.	9.1	83.3	J12XW1			Max.	102
4.1	J12XW2					52.8	J12XW2				
4.1	J12XW3					71.0	J12XW3				
4.7	J12XW4	Lognormal distribution?		Normal distribution?		85.2	J12XW4	Lognormal distribution?		Normal distribution?	
9.1	J12XW5	r-squared is: 0.913		r-squared is: 0.813		101	J12XW5	r-squared is: 0.977		r-squared is: 0.948	
8.1	J12XW6	Recommendations:				57.2	J12XW6	Recommendations:			
6.7	J12XW7	Use lognormal distribution.				72.4	J12XW7	Use lognormal distribution.			
6.5	J12XW8					62.9	J12XW8				
4.5	J12XW9					57.6	J12XW9				
3.7	J12XX0	UCL (Land's method) is		5.0		61.6	J12XX0	UCL (Land's method) is		75.9	
3.3	J12XX1					102	J12XX1				
4.3	J12XX2					64.3	J12XX2				
2.8	J12XX3					59.5	J12XX3				
2.8	J12XX4					68.0	J12XX4				
2.9	J12XX5					52.3	J12XX5				
DATA	ID	Beryllium 95% UCL Calculation				DATA	ID	Boron 95% UCL Calculation			
0.22	J12XV3					0.33	J12XV3				
0.33	J12XV4/J12XY3					1.6	J12XV4/J12XY3				
0.28	J12XV5	Number of samples		Uncensored values		0.33	J12XV5	Number of samples		Uncensored values	
0.37	J12XV6	Uncensored	23	Mean	0.37	2.2	J12XV6	Uncensored	23	Mean	0.8
0.33	J12XV7/J12XY4	Censored		Lognormal mean	0.37	1.3	J12XV7/J12XY4	Censored		Lognormal mean	0.8
0.30	J12XV8	Detection limit or PQL		Std. devn.	0.07	0.34	J12XV8	Detection limit or PQL		Std. devn.	0.6
0.34	J12XV9	Method detection limit		Median	0.36	0.93	J12XV9	Method detection limit		Median	0.8
0.33	J12XW0	TOTAL	23	Min.	0.22	1.7	J12XW0	TOTAL	23	Min.	0.33
0.37	J12XW1			Max.	0.55	0.96	J12XW1			Max.	2.2
0.31	J12XW2					0.34	J12XW2				
0.31	J12XW3					0.33	J12XW3				
0.36	J12XW4	Lognormal distribution?		Normal distribution?		0.34	J12XW4	Lognormal distribution?		Normal distribution?	
0.47	J12XW5	r-squared is: 0.964		r-squared is: 0.953		0.33	J12XW5	r-squared is: 0.826		r-squared is: 0.841	
0.47	J12XW6	Recommendations:				0.33	J12XW6	Recommendations:			
0.38	J12XW7	Use lognormal distribution.				0.34	J12XW7	Reject BOTH lognormal and normal distributions.			
0.39	J12XW8					0.33	J12XW8				
0.40	J12XW9					0.33	J12XW9				
0.55	J12XX0	UCL (Land's method) is		0.40		0.83	J12XX0	UCL (based on Z-statistic) is		1.0	
0.48	J12XX1					1.5	J12XX1				
0.43	J12XX2					1.0	J12XX2				
0.35	J12XX3					1.4	J12XX3				
0.38	J12XX4					0.86	J12XX4				
0.35	J12XX5					1.1	J12XX5				

49 PQL = practical quantitation limit

UCL = upper confidence limit

CALCULATION SHEET

Washington Closure Hanford

Originator J. M. Capron *JMC*

Project 100-B/C Remaining Pipes and Sewers Field Remediation

Subject 100-C-9:1 (South) Waste Site Cleanup Verification 95% UCL Calculations

Date 11/13/06

Job No. 14655

Calc. No. 0100C-CA-V0029

Checked T. M. Blakley *TMB*

Rev. No. 0

Date 4/16/06

Sheet No. 9 of 13

Ecology Software (MTCASat) Results

DATA	ID	Chromium 95% UCL Calculation				DATA	ID	Cobalt 95% UCL Calculation			
6.1	J12XV3					7.1	J12XV3				
9.0	J12XV4/J12XY3					8.2	J12XV4/J12XY3				
10.8	J12XV5	Number of samples		Uncensored values		7.2	J12XV5	Number of samples		Uncensored values	
10.2	J12XV6	Uncensored	23	Mean	12.1	7.9	J12XV6	Uncensored	23	Mean	9.1
12.5	J12XV7/J12XY4	Censored		Lognormal mean	11.6	7.5	J12XV7/J12XY4	Censored		Lognormal mean	9.1
4.4	J12XV8	Detection limit or PQL		Std. devn.	11.0	9.2	J12XV8	Detection limit or PQL		Std. devn.	1.7
10.0	J12XV9	Method detection limit		Median	10.0	7.7	J12XV9	Method detection limit		Median	8.5
8.3	J12XW0	TOTAL	23	Min.	4.4	8.4	J12XW0	TOTAL	23	Min.	7.1
15.4	J12XW1			Max.	60.6	7.6	J12XW1			Max.	12.5
8.1	J12XW2					8.2	J12XW2				
12.4	J12XW3					7.2	J12XW3				
16.9	J12XW4	Lognormal distribution?		Normal distribution?		7.6	J12XW4	Lognormal distribution?		Normal distribution?	
11.4	J12XW5	r-squared is: 0.814		r-squared is: 0.437		9.5	J12XW5	r-squared is: 0.943		r-squared is: 0.919	
12.7	J12XW6	Recommendations:				10.1	J12XW6	Recommendations:			
60.6	J12XW7	Reject BOTH lognormal and normal distributions.				9.9	J12XW7	Use lognormal distribution.			
13.4	J12XW8					9.2	J12XW8				
8.6	J12XW9					10.3	J12XW9				
9.0	J12XX0	UCL (based on Z-statistic) is		15.9		12.3	J12XX0	UCL (Land's method) is		9.7	
6.6	J12XX1					12.5	J12XX1				
10.0	J12XX2					11.9	J12XX2				
7.1	J12XX3					8.5	J12XX3				
6.9	J12XX4					11.3	J12XX4				
7.5	J12XX5					9.7	J12XX5				
DATA	ID	Copper 95% UCL Calculation				DATA	ID	Lead 95% UCL Calculation			
14.2	J12XV3					5.5	J12XV3				
13.9	J12XV4/J12XY3					4.8	J12XV4/J12XY3				
15.0	J12XV5	Number of samples		Uncensored values		5.2	J12XV5	Number of samples		Uncensored values	
17.3	J12XV6	Uncensored	23	Mean	17.1	5.6	J12XV6	Uncensored	23	Mean	5.7
14.6	J12XV7/J12XY4	Censored		Lognormal mean	17.1	7.2	J12XV7/J12XY4	Censored		Lognormal mean	5.7
16.2	J12XV8	Detection limit or PQL		Std. devn.	2.4	3.8	J12XV8	Detection limit or PQL		Std. devn.	1.8
14.0	J12XV9	Method detection limit		Median	16.5	5.8	J12XV9	Method detection limit		Median	5.5
17.3	J12XW0	TOTAL	23	Min.	13.9	6.0	J12XW0	TOTAL	23	Min.	3.1
15.9	J12XW1			Max.	21.1	6.6	J12XW1			Max.	10.7
16.2	J12XW2					5.1	J12XW2				
14.8	J12XW3					6.0	J12XW3				
15.9	J12XW4	Lognormal distribution?		Normal distribution?		6.1	J12XW4	Lognormal distribution?		Normal distribution?	
21.1	J12XW5	r-squared is: 0.945		r-squared is: 0.930		10.7	J12XW5	r-squared is: 0.964		r-squared is: 0.889	
20.8	J12XW6	Recommendations:				9.5	J12XW6	Recommendations:			
17.0	J12XW7	Use lognormal distribution.				5.0	J12XW7	Use lognormal distribution.			
19.6	J12XW8					7.6	J12XW8				
19.0	J12XW9					6.0	J12XW9				
21.1	J12XX0	UCL (Land's method) is		18.0		4.8	J12XX0	UCL (Land's method) is		6.4	
19.7	J12XX1					4.6	J12XX1				
20.7	J12XX2					5.1	J12XX2				
16.5	J12XX3					4.3	J12XX3				
16.8	J12XX4					3.1	J12XX4				
16.4	J12XX5					3.5	J12XX5				

49 PQL = practical quantitation limit

UCL = upper confidence limit

CALCULATION SHEET

Washington Closure Hanford

Originator J. M. Capron

Date 11/13/06

Calc. No. 0100C-CA-V0029

Rev. No. 0

Project 100-B/C Remaining Pipes and Sewers Field Remediation

Job No. 14655

Checked T. M. Blakley

Date 11/16/06

Subject 100-C-9:1 (South) Waste Site Cleanup Verification 95% UCL Calculations

Sheet No. 10 of 13

Ecology Software (MTCASat) Results

DATA	ID	Manganese 95% UCL Calculation				DATA	ID	Mercury 95% UCL Calculation			
277	J12XV3					0.005	J12XV3				
385	J12XV4/J12XY3					0.008	J12XV4/J12XY3				
292	J12XV5	Number of samples		Uncensored values		0.005	J12XV5	Number of samples		Uncensored values	
333	J12XV6	Uncensored	23	Mean	375	0.01	J12XV6	Uncensored	23	Mean	0.9
316	J12XV7/J12XY4	Censored		Lognormal mean	375	0.03	J12XV7/J12XY4	Censored		Lognormal mean	1.7
379	J12XV8	Detection limit or PQL		Std. devn.	63	0.12	J12XV8	Detection limit or PQL		Std. devn.	2.1
336	J12XV9	Method detection limit		Median	358	0.11	J12XV9	Method detection limit		Median	0.1
356	J12XW0	TOTAL	23	Min.	277	0.01	J12XW0	TOTAL	23	Min.	0.005
327	J12XW1			Max.	497	0.005	J12XW1			Max.	8.8
334	J12XW2					0.01	J12XW2				
303	J12XW3					0.005	J12XW3				
311	J12XW4	Lognormal distribution?		Normal distribution?		0.07	J12XW4	Lognormal distribution?		Normal distribution?	
432	J12XW5	r-squared is: 0.972		r-squared is: 0.961		0.89	J12XW5	r-squared is: 0.913		r-squared is: 0.510	
457	J12XW6	Recommendations:				2.6	J12XW6	Recommendations:			
437	J12XW7	Use lognormal distribution.				0.49	J12XW7	Use lognormal distribution.			
393	J12XW8					8.8	J12XW8				
388	J12XW9					0.06	J12XW9				
454	J12XX0	UCL (Land's method) is		400		4.3	J12XX0	UCL (Land's method) is		22.7	
497	J12XX1					0.14	J12XX1				
449	J12XX2					3.5	J12XX2				
351	J12XX3					0.005	J12XX3				
467	J12XX4					0.05	J12XX4				
358	J12XX5					0.57	J12XX5				
DATA	ID	Nickel 95% UCL Calculation				DATA	ID	Vanadium 95% UCL Calculation			
7.9	J12XV3					37.6	J12XV3				
10.6	J12XV4/J12XY3					41.2	J12XV4/J12XY3				
12.6	J12XV5	Number of samples		Uncensored values		37.1	J12XV5	Number of samples		Uncensored values	
11.4	J12XV6	Uncensored	23	Mean	11.9	40.4	J12XV6	Uncensored	23	Mean	45.0
13.8	J12XV7/J12XY4	Censored		Lognormal mean	11.9	35.1	J12XV7/J12XY4	Censored		Lognormal mean	44.9
8.4	J12XV8	Detection limit or PQL		Std. devn.	2.3	42.8	J12XV8	Detection limit or PQL		Std. devn.	11.4
10.1	J12XV9	Method detection limit		Median	11.7	39.2	J12XV9	Method detection limit		Median	40.4
12.0	J12XW0	TOTAL	23	Min.	7.9	44.8	J12XW0	TOTAL	23	Min.	33.8
16.4	J12XW1			Max.	17.0	34.2	J12XW1			Max.	77.0
11.5	J12XW2					43.3	J12XW2				
13.6	J12XW3					33.8	J12XW3				
17.0	J12XW4	Lognormal distribution?		Normal distribution?		37.1	J12XW4	Lognormal distribution?		Normal distribution?	
13.2	J12XW5	r-squared is: 0.982		r-squared is: 0.968		39.5	J12XW5	r-squared is: 0.879		r-squared is: 0.817	
15.1	J12XW6	Recommendations:				37.4	J12XW6	Recommendations:			
10.8	J12XW7	Use lognormal distribution.				51.7	J12XW7	Reject BOTH lognormal and normal distributions.			
11.7	J12XW8					40.1	J12XW8				
11.7	J12XW9					36.9	J12XW9				
11.0	J12XX0	UCL (Land's method) is		12.8		77.0	J12XX0	UCL (based on Z-statistic) is		48.9	
11.6	J12XX1					65.3	J12XX1				
12.8	J12XX2					60.5	J12XX2				
9.6	J12XX3					44.7	J12XX3				
12.1	J12XX4					62.3	J12XX4				
9.2	J12XX5					52.6	J12XX5				

49 PQL = practical quantitation limit

UCL = upper confidence limit

CALCULATION SHEET

Washington Closure Hanford

Originator J. M. Capron *JMC*

Date 11/13/06

Calc. No. 0100C-CA-V0029

Rev. No. 0

Project 100-B/C Remaining Pipes and Sewers Field Remediation

Job No. 14655

Checked T. M. Blakley *TMB*

Date 11/16/06

Subject 100-C-9:1 (South) Waste Site Cleanup Verification 95% UCL Calculations

Sheet No. 11 of 13

Ecology Software (MTCASat) Results

DATA	ID	Zinc 95% UCL Calculation			
37.1	J12XV3				
40.3	J12XV4/J12XY3				
40.8	J12XV5	Number of samples		Uncensored values	
46.9	J12XV6	Uncensored	23	Mean	46.1
42.4	J12XV7/J12XY4	Censored		Lognormal mean	46.1
42.8	J12XV8	Detection limit or PQL		Std. devn.	5.6
39.6	J12XV9	Method detection limit		Median	46.0
56.4	J12XW0	TOTAL	23	Min.	37.1
46.9	J12XW1			Max.	57.9
42.3	J12XW2				
42.2	J12XW3				
46.9	J12XW4	Lognormal distribution?		Normal distribution?	
51.2	J12XW5	r-squared is: 0.982		r-squared is: 0.970	
52.3	J12XW6	Recommendations:			
49.5	J12XW7	Use lognormal distribution.			
46.7	J12XW8				
46.0	J12XW9				
57.9	J12XX0	UCL (Land's method) is	48.2		
51.6	J12XX1				
52.9	J12XX2				
38.8	J12XX3				
45.5	J12XX4				
44.0	J12XX5				

25 PQL = practical quantitation limit

UCL = upper confidence limit

CALCULATION SHEET

Washington Closure Hanford

Originator J. M. Capron
Project 100-B/C Remaining Pipes and Sewers Field Remediation
Subject 100-C-9:1 (South) Waste Site Cleanup Verification 95% UCL Calculations

Date 11/13/06
Job No. 14655

Calc. No. 0100C-CA-V0029
Checked T. M. Blakley

Rev. No. 0
Date 11/16/06
Sheet No. 12 of 13

1 Duplicate Analysis

Sample Node	Sample Number	Sample Date	Aluminum			Antimony			Arsenic			Barium			Beryllium			Boron			Cadmium			Calcium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
2	J12XV4	7/27/06	5780		7.9	0.40	U	0.40	2.9		0.56	81.4		0.06	0.33		0.06	1.5		0.66	0.19	U	0.19	4540		4.5
Duplicate of J12XV4	J12XY3	7/27/06	6740		6.9	0.43	UJ	0.43	2.5		0.60	70.6	C	0.02	0.33		0.06	1.6		0.24	0.24		0.21	4890	J	6.4
5	J12XV7	7/27/06	6650		8.0	0.48		0.41	3.9		0.57	78.4		0.06	0.32		0.06	1.1		0.67	0.19	U	0.19	5720		4.6
Duplicate of J12XV7	J12XY4	7/27/06	6960		6.8	0.42	UJ	0.42	3.2		0.59	76.8	C	0.02	0.33		0.06	1.4		0.23	0.26		0.20	5650	J	6.3

6 Analysis:

Duplicate Analysis	TDL		5	0.6	10	2	0.5	2	0.2	100
	Both > PQL?	Yes (continue)	No - evaluate difference	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	No - evaluate difference	Yes (continue)
Duplicate Analysis	Both >5xTDL?	Yes (calc RPD)	No - evaluate difference	Yes (calc RPD)	No - evaluate difference	Yes (calc RPD)	No - evaluate difference	No - evaluate difference		Yes (calc RPD)
	RPD	15%				14%				7.4%
	Difference >2xTDL?	Not applicable	No - acceptable	No - acceptable	No - acceptable	Not applicable	No - acceptable	No - acceptable	No - acceptable	Not applicable
Duplicate Analysis	Both > PQL?	Yes (continue)	No - evaluate difference	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	No - evaluate difference	Yes (continue)
	Both >5xTDL?	Yes (calc RPD)	No - evaluate difference	Yes (calc RPD)	No - evaluate difference	Yes (calc RPD)	No - evaluate difference	No - evaluate difference		Yes (calc RPD)
	RPD	4.6%				2.1%				1.2%
Duplicate Analysis	Difference >2xTDL?	Not applicable	No - acceptable	No - acceptable	No - acceptable	Not applicable	No - acceptable	No - acceptable	No - acceptable	Not applicable

16

Sample Node	Sample Number	Sample Date	Chromium			Cobalt			Copper			Hexavalent Chromium			Iron			Lead			Lithium			Magnesium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
2	J12XV4	7/27/06	8.5		0.36	8.0		0.39	14.1		0.33	0.20		0.20	18500		9.6	5.3		0.85	5.7	C	0.08	4040		2.7
Duplicate of J12XV4	J12XY3	7/27/06	9.5		0.13	8.4		0.14	13.6		0.12	0.21	U	0.21	20200	C	1.6	4.3		0.91	6.2	C	0.09	4270		11.5
5	J12XV7	7/27/06	12.5		0.36	7.3		0.39	14.5		0.33	0.20	U	0.20	17000		9.7	7.8		0.86	8.3	C	0.08	4940		2.7
Duplicate of J12XV7	J12XY4	7/27/06	12.5		0.13	7.7		0.13	14.7		0.12	0.20	U	0.20	17700	C	1.6	6.5		0.90	8.3	C	0.09	5150		11.3

21 Analysis:

Duplicate Analysis	TDL		1	2	1	0.5	5	5	2.5	75
	Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	No - evaluate difference	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)
Duplicate Analysis	Both >5xTDL?	Yes (calc RPD)	No - evaluate difference	Yes (calc RPD)	Yes (calc RPD)		Yes (calc RPD)	No - evaluate difference	No - evaluate difference	Yes (calc RPD)
	RPD	11%			3.6%		8.8%			5.5%
	Difference >2xTDL?	Not applicable	No - acceptable	Not applicable	Not applicable	No - acceptable	Not applicable	No - acceptable	No - acceptable	Not applicable
Duplicate Analysis	Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	No - evaluate difference	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)
	Both >5xTDL?	Yes (calc RPD)	No - evaluate difference	Yes (calc RPD)	Yes (calc RPD)		Yes (calc RPD)	No - evaluate difference	No - evaluate difference	Yes (calc RPD)
	RPD	0%			1.4%		4.0%			4.2%
Duplicate Analysis	Difference >2xTDL?	Not applicable	No - acceptable	Not applicable	Not applicable	No - acceptable	Not applicable	No - acceptable	No - acceptable	Not applicable

31

Sample Node	Sample Number	Sample Date	Manganese			Mercury			Nickel			Phosphorus			Potassium			Silicon			Sodium			Strontium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
2	J12XV4	7/27/06	411		0.08	0.01	U	0.01	10.1		0.66	911		2.5	1260		6.3	482		6.3	109		2.1	21.5		0.03
Duplicate of J12XV4	J12XY3	7/27/06	358		0.03	0.02	U	0.02	11.0		0.24	898		2.6	1440		2.2	602		2.2	148		7.4	22.9		0.01
5	J12XV7	7/27/06	311		0.08	0.03		0.01	13.3		0.67	868		2.5	1220		6.3	647		6.3	119		2.1	29.9		0.03
Duplicate of J12XV7	J12XY4	7/27/06	321		0.03	0.02		0.01	14.2		0.23	890		2.6	1170		2.2	634		2.2	138		7.3	29.2		0.01

36 Analysis:

Duplicate Analysis	TDL		5	0.2	4	1.3	400	2	50	1
	Both > PQL?	Yes (continue)	No - evaluate difference	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)
Duplicate Analysis	Both >5xTDL?	Yes (calc RPD)	No - evaluate difference	Yes (calc RPD)	Yes (calc RPD)	No - evaluate difference	Yes (calc RPD)	No - evaluate difference	No - evaluate difference	Yes (calc RPD)
	RPD	14%			1.4%		22%			6.3%
	Difference >2xTDL?	Not applicable	No - acceptable	Not applicable	Not applicable	No - acceptable	Not applicable	No - acceptable	No - acceptable	Not applicable
Duplicate Analysis	Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)
	Both >5xTDL?	Yes (calc RPD)	No - evaluate difference	No - evaluate difference	Yes (calc RPD)	No - evaluate difference	Yes (calc RPD)	No - evaluate difference	No - evaluate difference	Yes (calc RPD)
	RPD	3.2%			2.5%		2.0%			2.4%
Duplicate Analysis	Difference >2xTDL?	Not applicable	No - acceptable	No - acceptable	Not applicable	No - acceptable	Not applicable	No - acceptable	No - acceptable	Not applicable

46 C = method blank contamination (inorganic constituents)

47 J = estimated

48 PQL = practical quantitation limit

49 Q = qualifier

RPD = relative percent difference

TDL = target detection limit

U = undetected

CALCULATION SHEET

Washington Closure Hanford

Originator J. M. Capron *JMC* Date 11/13/06 Checked T. M. Blakley *TMB* Date 11/16/06
 Job No. 14655 Calc. No. 0100C-CA-V0029 Rev. No. 0 Sheet No. 13 of 13
 Project 100-B/C Remaining Pipes and Sewers Field Remediation
 Subject 100-C-9:1 (South) Waste Site Cleanup Verification 95% UCL Calculations

1 Duplicate Analysis (continued)

Sample Node	Sample Number	Sample Date	Titanium			Vanadium		
			mg/kg	Q	PQL	mg/kg	Q	PQL
2	J12XV4	7/27/06	1170		0.08	38.8		0.25
5	Duplicate of J12XV4	J12XY3	1270		0.03	43.6		0.09
5	J12XV7	7/27/06	912		0.08	34.9		0.25
	Duplicate of J12XV7	J12XY4	923		0.03	35.2		0.09

6 Analysis:

TDL		0.5	2.5
Duplicate Analysis	Both > PQL?	Yes (continue)	Yes (continue)
	Both >5xTDL?	Yes (calc RPD)	Yes (calc RPD)
	RPD	8.2%	12%
	Difference >2xTDL?	Not applicable	Not applicable
Duplicate Analysis	Both > PQL?	Yes (continue)	Yes (continue)
	Both >5xTDL?	Yes (calc RPD)	Yes (calc RPD)
	RPD	1.2%	0.86%
	Difference >2xTDL?	Not applicable	Not applicable

Sample Node	Sample Number	Sample Date	Zinc			Zirconium		
			mg/kg	Q	PQL	mg/kg	Q	PQL
2	J12XV4	7/27/06	40.8		0.44	20.0		2.9
5	Duplicate of J12XV4	J12XY3	39.8		0.16	23.8		3.1
5	J12XV7	7/27/06	43.0		0.44	12.8		2.9
	Duplicate of J12XV7	J12XY4	41.7		0.15	13.8		3.1

23 Analysis:

TDL		1	2.5
Duplicate Analysis	Both > PQL?	Yes (continue)	Yes (continue)
	Both >5xTDL?	Yes (calc RPD)	Yes (calc RPD)
	RPD	2.5%	17%
	Difference >2xTDL?	Not applicable	Not applicable
Duplicate Analysis	Both > PQL?	Yes (continue)	Yes (continue)
	Both >5xTDL?	Yes (calc RPD)	Yes (calc RPD)
	RPD	3.1%	7.5%
	Difference >2xTDL?	Not applicable	Not applicable

33 PQL = practical quantitation limit

34 Q = qualifier

35 RPD = relative percent difference

36 TDL = target detection limit

Attachment 1. 100-C-9:1 (South) Verification Sampling Results.

Sample Location	Sample Number	Sample Date	Aluminum			Antimony			Arsenic			Barium			Beryllium			Boron		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
1	J12XV3	7/27/06	4430		8.0	0.41	U	0.41	3.3		0.56	46.9		0.06	0.22		0.06	0.66	U	0.66
2	J12XV4	7/27/06	5780		7.9	0.40	U	0.40	2.9		0.56	81.4		0.06	0.33		0.06	1.5		0.66
Duplicate of J12XV4	J12XY3	7/27/06	6740		6.9	0.43	UJ	0.43	2.5		0.60	70.6	C	0.02	0.33		0.06	1.6		0.24
3	J12XV5	7/27/06	6000		7.9	0.40	U	0.40	3.4		0.56	63.6		0.05	0.28		0.05	0.66	U	0.66
4	J12XV6	7/27/06	7050		8.1	0.47		0.41	4.7		0.57	84.6		0.06	0.37		0.06	2.2		0.67
5	J12XV7	7/27/06	6650		8.0	0.48		0.41	3.9		0.57	78.4		0.06	0.32		0.06	1.1		0.67
Duplicate of J12XV7	J12XY4	7/27/06	6960		6.8	0.42	UJ	0.42	3.2		0.59	76.8	C	0.02	0.33		0.06	1.4		0.23
6	J12XV8	7/27/06	4470		8.0	0.41	U	0.41	3.0		0.57	86.6		0.06	0.30		0.06	0.67	U	0.67
7	J12XV9	7/27/06	5930		8.0	0.41	U	0.41	3.0		0.57	64.5		0.06	0.34		0.06	0.93		0.67
8	J12XW0	7/27/06	6130		8.0	0.41	U	0.41	3.7		0.57	62.8		0.06	0.33		0.06	1.7		0.67
9	J12XW1	7/27/06	8040		7.9	0.42		0.40	4.8		0.56	83.3		0.06	0.37		0.06	0.96		0.66
10	J12XW2	7/27/06	5750		8.0	0.41	U	0.41	4.1		0.57	52.8		0.06	0.31		0.06	0.67	U	0.67
11	J12XW3	7/27/06	6650		8.0	0.55		0.41	4.1		0.56	71.0		0.06	0.31		0.06	0.66	U	0.66
12	J12XW4	7/27/06	8180		8.0	0.41	U	0.41	4.7		0.57	85.2		0.06	0.36		0.06	0.67	U	0.67
13	J12XW5	7/27/06	7460		7.9	0.51		0.40	9.1		0.56	101		0.06	0.47		0.06	0.66	U	0.66
14	J12XW6	7/27/06	8480		7.9	0.60		0.40	8.1		0.55	57.2		0.05	0.47		0.05	0.65	U	0.65
15	J12XW7	7/27/06	5990		8.1	0.62		0.41	6.7		0.57	72.4		0.06	0.38		0.06	0.68	U	0.68
16	J12XW8	7/27/06	6230		7.9	0.48		0.40	6.5		0.56	62.9		0.06	0.39		0.06	0.66	U	0.66
17	J12XW9	7/27/06	6840		8.0	0.41	U	0.41	4.5		0.56	57.6		0.06	0.40		0.06	0.66	U	0.66
18	J12XX0	7/27/06	6960		6.8	0.42	UJ	0.42	3.7		0.59	61.6	C	0.02	0.55		0.06	0.83		0.23
19	J12XX1	7/27/06	6510		6.9	0.43	UJ	0.43	3.3		0.59	102	C	0.02	0.48		0.06	1.5		0.23
20	J12XX2	7/27/06	7210		6.9	0.59	J	0.43	4.3		0.59	64.3	C	0.02	0.43		0.06	1.0		0.23
21	J12XX3	7/27/06	5600		6.7	0.41	UJ	0.41	2.8		0.58	59.5	C	0.02	0.35		0.06	1.4		0.23
22	J12XX4	7/27/06	5950		6.8	0.42	UJ	0.42	2.8		0.58	68.0	C	0.02	0.38		0.06	0.86		0.23
23	J12XX5	7/27/06	5080		6.9	0.43	UJ	0.43	2.9		0.59	52.3	C	0.02	0.35		0.06	1.1		0.23
OB 7FF	J12XY1	7/31/06	5850		6.8	0.42	UJ	0.42	3.1		0.59	59.6	C	0.02	0.32		0.06	1.5		0.23
BCL 8FF	J12XY2	7/31/06	6120		6.8	0.42	UJ	0.42	3.1		0.58	60.3	C	0.02	0.32		0.06	1.3		0.23
OB 9FF	J12XX9	7/31/06	5810		6.8	0.42	UJ	0.42	3.0		0.58	59.3	C	0.02	0.33		0.06	1.3		0.23
OB 10FF	J12XX7	7/31/06	5860		6.8	0.42	UJ	0.42	3.0		0.59	56.5	C	0.02	0.34		0.06	1.4		0.23
BCL 11FF	J12XX8	7/31/06	5540		6.8	0.42	UJ	0.42	2.9		0.59	54.2	C	0.02	0.31		0.06	1.2		0.23
BCL 12FF	J12XY0	7/31/06	5900		6.7	0.42	UJ	0.42	2.7		0.58	62.6	C	0.02	0.37		0.06	1.8		0.23
OB 13FF	J12XX6	7/31/06	5830		6.8	0.42	UJ	0.42	2.9		0.58	58.0	C	0.02	0.38		0.06	1.5		0.23
Equipment blank	J12XY5	7/27/06	44.4		2.3	0.42	UJ	0.42	0.59	U	0.59	1.5	C	0.02	0.02	U	0.02	0.23	U	0.23

Note: The following abbreviations apply to all Attachment 1 tables.

Note: Data qualified with C or J are considered acceptable values.

BCL = below cleanup levels

C = method blank contamination (inorganic constituents)

J = estimated

OB = overburden

PQL = practical quantitation limit

Q = qualifier

U = undetected

Attachment	1	Sheet No	1 of 6
Originator	J. M. Capron <i>JMC</i>	Date	11/13/06
Checked	T. M. Blakley <i>TMB</i>	Date	11/16/06
Calc. No.	0100C-CA-V0029	Rev. No.	0

Attachment 1. 100-C-9:1 (South) Verification Sampling Results.

Sample Location	Sample Number	Sample Date	Cadmium			Calcium			Chromium			Cobalt			Copper			Hexavalent Chromium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
1	J12XV3	7/27/06	0.19	U	0.19	7410		4.5	6.1		0.36	7.1		0.39	14.2		0.33	0.20	U	0.20
2	J12XV4	7/27/06	0.19	U	0.19	4540		4.5	8.5		0.36	8.0		0.39	14.1		0.33	0.20		0.20
Duplicate of J12XV4	J12XY3	7/27/06	0.24		0.21	4890	J	6.4	9.5		0.13	8.4		0.14	13.6		0.12	0.21	U	0.21
3	J12XV5	7/27/06	0.19	U	0.19	5180		4.5	10.8		0.36	7.2		0.38	15.0		0.33	0.20	U	0.20
4	J12XV6	7/27/06	0.20	U	0.20	13500		4.6	10.2		0.37	7.9		0.39	17.3		0.34	0.20	U	0.20
5	J12XV7	7/27/06	0.19	U	0.19	5720		4.6	12.5		0.36	7.3		0.39	14.5		0.33	0.20	U	0.20
Duplicate of J12XV7	J12XY4	7/27/06	0.26		0.20	5650	J	6.3	12.5		0.13	7.7		0.13	14.7		0.12	0.20	U	0.20
6	J12XV8	7/27/06	0.19	U	0.19	8160		4.6	4.4		0.36	9.2		0.39	16.2		0.33	0.20	U	0.20
7	J12XV9	7/27/06	0.20	U	0.20	4040		4.6	10.0		0.36	7.7		0.39	14.0		0.33	0.20	U	0.20
8	J12XW0	7/27/06	0.20	U	0.20	6970		4.6	8.3		0.36	8.4		0.39	17.3		0.33	0.20	U	0.20
9	J12XW1	7/27/06	0.19	U	0.19	6430		4.5	15.4		0.36	7.6		0.39	15.9		0.33	0.20	U	0.20
10	J12XW2	7/27/06	0.19	U	0.19	8100		4.6	8.1		0.36	8.2		0.39	16.2		0.33	0.20	U	0.20
11	J12XW3	7/27/06	0.19	U	0.19	6240		4.5	12.4		0.36	7.2		0.39	14.8		0.33	0.20	U	0.20
12	J12XW4	7/27/06	0.20	U	0.20	6140		4.6	16.9		0.36	7.6		0.39	15.9		0.34	0.21		0.20
13	J12XW5	7/27/06	0.19	U	0.19	12900		4.5	11.4		0.36	9.5		0.39	21.1		0.33	0.29		0.20
14	J12XW6	7/27/06	0.19	U	0.19	13100		4.5	12.7		0.35	10.1		0.38	20.8		0.33	0.44		0.20
15	J12XW7	7/27/06	0.20	U	0.20	10300		4.6	60.6		0.37	9.9		0.39	17.0		0.34	11.0		0.20
15 resample	J13H30	9/28/06																0.21	U	0.21
16	J12XW8	7/27/06	0.19	U	0.19	12000		4.5	13.4		0.36	9.2		0.39	19.6		0.33	1.8		0.20
17	J12XW9	7/27/06	0.19	U	0.19	7200		4.5	8.6		0.36	10.3		0.39	19.0		0.33	0.20	U	0.20
18	J12XX0	7/27/06	0.20	U	0.20	8490	J	6.3	9.0		0.13	12.3		0.13	21.1		0.12	0.24		0.20
19	J12XX1	7/27/06	0.20	U	0.20	8550	J	6.4	6.6		0.13	12.5		0.14	19.7		0.12	0.20	U	0.20
20	J12XX2	7/27/06	0.20	U	0.20	8360	J	6.4	10.0		0.13	11.9		0.14	20.7		0.12	0.20	U	0.20
21	J12XX3	7/27/06	0.20	U	0.20	6390	J	6.2	7.1		0.12	8.5		0.13	16.5		0.11	0.20	U	0.20
22	J12XX4	7/27/06	0.20	U	0.20	6900	J	6.3	6.9		0.12	11.3		0.13	16.8		0.11	0.20	U	0.20
23	J12XX5	7/27/06	0.20	U	0.20	7710	J	6.4	7.5		0.13	9.7		0.14	16.4		0.12	0.20	U	0.20
OB 7FF	J12XY1	7/31/06	0.24		0.20	5700	J	6.3	8.3		0.13	8.4		0.13	14.6		0.12	0.20	U	0.20
BCL 8FF	J12XY2	7/31/06	0.24		0.20	5690	J	6.3	9.8		0.12	8.5		0.13	14.1		0.11	0.20	U	0.20
OB 9FF	J12XX9	7/31/06	0.21		0.20	5730	J	6.3	8.7		0.12	8.1		0.13	14.8		0.11	0.20	U	0.20
OB 10FF	J12XX7	7/31/06	0.20	U	0.20	5910	J	6.3	8.4		0.13	8.4		0.14	14.9		0.12	0.20	U	0.20
BCL 11FF	J12XX8	7/31/06	0.20	U	0.20	6700	J	6.3	7.5		0.13	8.3		0.14	14.9		0.12	0.20	U	0.20
BCL 12FF	J12XY0	7/31/06	0.25		0.20	5980	J	6.2	8.1		0.12	9.0		0.13	15.1		0.11	0.20	U	0.20
OB 13FF	J12XX6	7/31/06	0.23		0.20	6000	J	6.3	9.5		0.12	8.8		0.13	15.7		0.11	0.27		0.20
Equipment blank	J12XY5	7/27/06	0.07	U	0.07	22.8	J	2.1	0.16		0.12	0.13	U	0.13	0.12	U	0.12	0.20	U	0.20

Attachment	1	Sheet No	2 of 6
Originator	J. M. Capron	Date	11/13/06
Checked	T. M. Blakley	Date	
Calc. No.	0100C-CA-V0029	Rev. No.	0

Attachment 1. 100-C-9:1 (South) Verification Sampling Results.

Sample Location	Sample Number	Sample Date	Iron			Lead			Lithium			Magnesium			Manganese			Mercury		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
1	J12XV3	7/27/06	16900		9.6	5.5		0.86	4.7	C	0.08	3600		2.7	277		0.08	0.01	U	0.01
2	J12XV4	7/27/06	18500		9.6	5.3		0.85	5.7	C	0.08	4040		2.7	411		0.08	0.01	U	0.01
Duplicate of J12XV4	J12XY3	7/27/06	20200	C	1.6	4.3		0.91	6.2	C	0.09	4270		11.5	358		0.03	0.02	U	0.02
3	J12XV5	7/27/06	17800		9.5	5.2		0.85	7.5	C	0.08	4700		2.7	292		0.08	0.01	U	0.01
4	J12XV6	7/27/06	18300		9.8	5.6		0.87	7.6	C	0.08	4670		2.7	333		0.08	0.02	U	0.02
5	J12XV7	7/27/06	17000		9.7	7.8		0.86	8.3	C	0.08	4940		2.7	311		0.08	0.03		0.01
Duplicate of J12XV7	J12XY4	7/27/06	17700	C	1.6	6.5		0.90	8.3	C	0.09	5150		11.3	321		0.03	0.02		0.01
6	J12XV8	7/27/06	22200		9.7	3.8		0.86	4.6	C	0.08	4540		2.7	379		0.08	0.12		0.01
7	J12XV9	7/27/06	18000		9.7	5.8		0.86	5.8	C	0.08	4000		2.7	336		0.08	0.11		0.01
8	J12XW0	7/27/06	20700		9.7	6.0		0.86	6.7	C	0.08	4680		2.7	356		0.08	0.02	U	0.02
9	J12XW1	7/27/06	18300		9.6	6.6		0.85	11.0	C	0.08	5900		2.7	327		0.08	0.01	U	0.01
10	J12XW2	7/27/06	21100		9.7	5.1		0.86	7.0	C	0.08	5220		2.7	334		0.08	0.02	U	0.02
11	J12XW3	7/27/06	16900		9.6	6.0		0.86	8.5	C	0.08	5190		2.7	303		0.08	0.01	U	0.01
12	J12XW4	7/27/06	18600		9.7	6.1		0.87	10.8	C	0.08	5750		2.7	311		0.08	0.07		0.01
13	J12XW5	7/27/06	22300		9.6	10.7		0.85	10.4	C	0.08	6420		2.7	432		0.08	0.89		0.01
14	J12XW6	7/27/06	22300		9.5	9.5		0.85	13.0	C	0.08	7100		2.6	457		0.08	2.6		0.05
15	J12XW7	7/27/06	24100		9.8	5.0		0.87	6.7	C	0.08	5480		2.7	437		0.08	0.49		0.01
16	J12XW8	7/27/06	20200		9.6	7.6		0.85	7.6	C	0.08	5430		2.7	393		0.08	8.8		0.15
17	J12XW9	7/27/06	21900		9.7	6.0		0.86	8.2	C	0.08	5540		2.7	388		0.08	0.06		0.02
18	J12XX0	7/27/06	32700	C	1.6	4.8		0.90	7.1	C	0.09	6000		11.3	454		0.03	4.3		0.08
19	J12XX1	7/27/06	30100	C	1.6	4.6		0.90	6.5	C	0.09	5700		11.4	497		0.03	0.14		0.01
20	J12XX2	7/27/06	28400	C	1.6	5.1		0.90	7.6	C	0.09	6080		11.4	449		0.03	3.5		0.08
21	J12XX3	7/27/06	20700	C	1.5	4.3		0.88	5.6	C	0.08	4270		11.1	351		0.03	0.01	U	0.01
22	J12XX4	7/27/06	27000	C	1.6	3.1		0.89	5.8	C	0.09	5210		11.2	467		0.03	0.05		0.02
23	J12XX5	7/27/06	23800	C	1.6	3.5		0.90	4.6	C	0.09	4480		11.4	358		0.03	0.57		0.01
OB 7FF	J12XY1	7/31/06	19700	C	1.6	4.9		0.90	5.8	C	0.09	4260		11.3	350		0.03	0.01	U	0.01
BCL 8FF	J12XY2	7/31/06	20100	C	1.5	5.2		0.89	6.3	C	0.09	4490		11.2	347		0.03	0.06		0.02
OB 9FF	J12XX9	7/31/06	19300	C	1.5	5.0		0.89	6.1	C	0.09	4360		11.2	336		0.03	0.01	U	0.01
OB 10FF	J12XX7	7/31/06	19800	C	1.6	4.6		0.90	6.0	C	0.09	4320		11.3	356		0.03	0.02	U	0.02
BCL 11FF	J12XX8	7/31/06	20900	C	1.6	4.3		0.90	5.5	C	0.09	4360		11.3	330		0.03	0.01	U	0.01
BCL 12FF	J12XY0	7/31/06	22400	C	1.5	3.9		0.88	5.5	C	0.09	4390		11.1	344		0.03	0.01	U	0.01
OB 13FF	J12XX6	7/31/06	22500	C	1.5	6.0		0.89	5.8	C	0.09	4530		11.2	351		0.03	0.01	U	0.01
Equipment blank	J12XY5	7/27/06	107	C	0.52	0.39		0.30	148	C	0.03	9.5		3.8	4.6		0.03	0.01	U	0.01

Attachment	I	Sheet No	3 of 6
Originator	J. M. Capron	Date	11/13/06
Checked	T. M. Blakley	Date	
Calc. No.	0100C-CA-V0029	Rev. No.	0

Attachment 1. 100-C-9:1 (South) Verification Sampling Results.

Sample Location	Sample Number	Sample Date	Molybdenum			Nickel			Phosphorus			Potassium			Selenium			Silicon		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
1	J12XV3	7/27/06	0.80	U	0.80	7.9		0.66	1050		2.5	941		6.3	0.43	U	0.43	546		6.3
2	J12XV4	7/27/06	0.80	U	0.80	10.1		0.66	911		2.5	1260		6.3	0.43	U	0.43	482		6.3
Duplicate of J12XV4	J12XY3	7/27/06	0.28	U	0.28	11.0		0.24	898		2.6	1440		227	0.46	U	0.46	602		2.2
3	J12XV5	7/27/06	0.79	U	0.79	12.6		0.66	940		2.5	954		6.2	0.43	U	0.43	581		6.2
4	J12XV6	7/27/06	0.81	U	0.81	11.4		0.67	801		2.5	1580		6.4	0.44	U	0.44	617		6.4
5	J12XV7	7/27/06	0.81	U	0.81	13.3		0.67	868		2.5	1220		6.3	0.44	U	0.44	647		6.3
Duplicate of J12XV7	J12XY4	7/27/06	0.28	U	0.28	14.2		0.23	890		2.6	1170		223	0.45	U	0.45	634		2.2
6	J12XV8	7/27/06	0.81	U	0.81	8.4		0.67	1370		2.5	944		6.3	0.44	U	0.44	472		6.3
7	J12XV9	7/27/06	0.81	U	0.81	10.1		0.67	916		2.5	1220		6.3	0.44	U	0.44	470		6.3
8	J12XW0	7/27/06	0.81	U	0.81	12.0		0.67	1110		2.5	1140		6.3	0.44	U	0.44	429		6.3
9	J12XW1	7/27/06	0.80	U	0.80	16.4		0.66	907		2.5	1170		6.3	0.43	U	0.43	681		6.3
10	J12XW2	7/27/06	0.81	U	0.81	11.5		0.67	1040		2.5	1150		6.3	0.44	U	0.44	606		6.3
11	J12XW3	7/27/06	0.80	U	0.80	13.6		0.66	906		2.5	1070		6.3	0.43	U	0.43	717		6.3
12	J12XW4	7/27/06	0.81	U	0.81	17.0		0.67	875		2.5	1090		6.3	0.44	U	0.44	645		6.3
13	J12XW5	7/27/06	0.80	U	0.80	13.2		0.66	981		2.5	1810		6.3	0.43	U	0.43	548		6.3
14	J12XW6	7/27/06	0.79	U	0.79	15.1		0.65	890		2.5	1850		6.2	0.43	U	0.43	476		6.2
15	J12XW7	7/27/06	0.82	U	0.82	10.8		0.68	1270		2.5	1200		6.4	0.44	U	0.44	617		6.4
16	J12XW8	7/27/06	0.80	U	0.80	11.7		0.66	1040		2.5	1390		6.3	0.43	U	0.43	575		6.3
17	J12XW9	7/27/06	0.80	U	0.80	11.7		0.66	1180		2.5	1610		6.3	0.43	U	0.43	620		6.3
18	J12XX0	7/27/06	0.28		0.28	11.0		0.23	1470		2.6	1390		223	0.45	U	0.45	406	J	2.2
19	J12XX1	7/27/06	0.32		0.28	11.6		0.23	1510		2.6	1180		225	0.46	U	0.46	547	J	2.2
20	J12XX2	7/27/06	0.28	U	0.28	12.8		0.23	1300		2.6	1370		224	0.46	U	0.46	466	J	2.2
21	J12XX3	7/27/06	0.27	U	0.27	9.6		0.23	1060		2.5	1140		218	0.44	U	0.44	520	J	2.1
22	J12XX4	7/27/06	0.30		0.28	12.1		0.23	1320		2.6	1100		222	0.45	U	0.45	506	J	2.2
23	J12XX5	7/27/06	0.29		0.28	9.2		0.23	1250		2.6	1050		224	0.46	U	0.46	507	J	2.2
OB 7FF	J12XY1	7/31/06	0.28	U	0.28	10.3		0.23	949		2.6	1290		223	0.45	U	0.45	516	J	2.2
BCL 8FF	J12XY2	7/31/06	0.28	U	0.28	12.0		0.23	917		2.6	1360		221	0.45	U	0.45	547	J	2.2
OB 9FF	J12XX9	7/31/06	0.28	U	0.28	10.8		0.23	981		2.6	1140		221	0.45	U	0.45	596	J	2.2
OB 10FF	J12XX7	7/31/06	0.28	U	0.28	10.2		0.23	934		2.6	1240		223	0.45	U	0.45	616	J	2.2
BCL 11FF	J12XX8	7/31/06	0.28	U	0.28	9.7		0.23	1000		2.6	1030		223	0.45	U	0.45	505	J	2.2
BCL 12FF	J12XY0	7/31/06	0.29		0.27	10.3		0.23	1110		2.6	1040		219	0.44	U	0.44	485	J	2.1
OB 13FF	J12XX6	7/31/06	0.28	U	0.28	10.7		0.23	1020		2.6	1160		221	0.45	U	0.45	521	J	2.2
Equipment blank	J12XY5	7/27/06	0.28	U	0.28	0.23	U	0.23	3.8		0.86	74.1	U	74.1	0.45	U	0.45	48.5	J	2.2

Attachment	1	Sheet No	4 of 6
Originator	J. M. Capron	Date	11/13/06
Checked	T. M. Blakley	Date	
Calc. No.	0100C-CA-V0029	Rev. No.	0

Attachment 1. 100-C-9:1 (South) Verification Sampling Results.

Sample Location	Sample Number	Sample Date	Silver			Sodium			Strontium			Thallium			Tin			Titanium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
1	J12XV3	7/27/06	0.19	U	0.19	161		2.1	21.8		0.03	0.64	U	0.64	3.0	U	3.0	1320		0.08
2	J12XV4	7/27/06	0.19	U	0.19	109		2.1	21.5		0.03	0.64	U	0.64	2.9	U	2.9	1170		0.08
Duplicate of J12XV4	J12XY3	7/27/06	0.07	U	0.07	148		7.4	22.9		0.01	0.69	U	0.69	3.1	U	3.1	1270		0.03
3	J12XV5	7/27/06	0.19	U	0.19	146		2.1	25.7		0.03	0.64	U	0.64	2.9	U	2.9	1090		0.08
4	J12XV6	7/27/06	0.20	U	0.20	262		2.1	46.1		0.03	0.66	U	0.66	3.0	U	3.0	1140		0.08
5	J12XV7	7/27/06	0.19	U	0.19	119		2.1	29.9		0.03	0.65	U	0.65	3.0	U	3.0	912		0.08
Duplicate of J12XV7	J12XY4	7/27/06	0.07	U	0.07	138		7.3	29.2		0.01	0.67	U	0.67	3.1	U	3.1	923		0.03
6	J12XV8	7/27/06	0.19	U	0.19	185		2.1	24.4		0.03	0.65	U	0.65	3.0	U	3.0	1640		0.08
7	J12XV9	7/27/06	0.20	U	0.20	110		2.1	21.0		0.03	0.65	U	0.65	3.0	U	3.0	1200		0.08
8	J12XW0	7/27/06	0.20	U	0.20	155		2.1	24.3		0.03	0.65	U	0.65	3.0	U	3.0	1480		0.08
9	J12XW1	7/27/06	0.19	U	0.19	174		2.1	32.7		0.03	0.64	U	0.64	2.9	U	2.9	860		0.08
10	J12XW2	7/27/06	0.19	U	0.19	152		2.1	25.0		0.03	0.65	U	0.65	3.0	U	3.0	1440		0.08
11	J12XW3	7/27/06	0.19	U	0.19	208		2.1	30.1		0.03	0.64	U	0.64	3.0	U	3.0	902		0.08
12	J12XW4	7/27/06	0.20	U	0.20	252		2.1	33.6		0.03	0.65	U	0.65	3.0	U	3.0	899		0.08
13	J12XW5	7/27/06	0.19	U	0.19	748		2.1	33.2		0.03	0.64	U	0.64	2.9	U	2.9	1320		0.08
14	J12XW6	7/27/06	0.19	U	0.19	292		2.1	27.3		0.03	0.64	U	0.64	2.9	U	2.9	1100		0.08
15	J12XW7	7/27/06	0.20	U	0.20	416		2.1	28.2		0.03	0.66	U	0.66	3.0	U	3.0	1770		0.08
16	J12XW8	7/27/06	0.19	U	0.19	267		2.1	29.7		0.03	0.64	U	0.64	2.9	U	2.9	1350		0.08
17	J12XW9	7/27/06	0.19	U	0.19	339		2.1	23.6		0.03	0.65	U	0.65	3.0	U	3.0	1270		0.08
18	J12XX0	7/27/06	0.07	U	0.07	305		7.3	24.0		0.01	0.67	U	0.67	3.1	U	3.1	2780		0.03
19	J12XX1	7/27/06	0.07	U	0.07	296		7.3	24.7		0.01	0.68	U	0.68	3.1	U	3.1	2310		0.03
20	J12XX2	7/27/06	0.07	U	0.07	291		7.3	25.5		0.01	0.68	U	0.68	3.1	U	3.1	2000		0.03
21	J12XX3	7/27/06	0.07	U	0.07	160		7.1	23.6		0.009	0.66	U	0.66	3.0	U	3.0	1380		0.03
22	J12XX4	7/27/06	0.07	U	0.07	294		7.2	22.3		0.01	0.67		0.67	3.1	U	3.1	2020		0.03
23	J12XX5	7/27/06	0.07	U	0.07	186		7.3	23.3		0.01	0.68	U	0.68	3.1	U	3.1	1800		0.03
OB 7FF	J12XY1	7/31/06	0.07	U	0.07	154		7.3	23.6		0.01	0.67	U	0.67	3.1	U	3.1	1360		0.03
BCL 8FF	J12XY2	7/31/06	0.07	U	0.07	126		7.2	22.7		0.01	0.67	U	0.67	3.1	U	3.1	1370		0.03
OB 9FF	J12XX9	7/31/06	0.07	U	0.07	115		7.2	22.8		0.01	0.67	U	0.67	3.1	U	3.1	1250		0.03
OB 10FF	J12XX7	7/31/06	0.07	U	0.07	161		7.3	22.4		0.01	0.68	U	0.68	3.1	U	3.1	1310		0.03
BCL 11FF	J12XX8	7/31/06	0.07	U	0.07	188		7.3	23.5		0.01	0.68	U	0.68	3.1	U	3.1	1530		0.03
BCL 12FF	J12XY0	7/31/06	0.07	U	0.07	164		7.1	27.8		0.009	0.66	U	0.66	3.0	U	3.0	1700		0.03
OB 13FF	J12XX6	7/31/06	0.07	U	0.07	144		7.2	23.0		0.01	0.67	U	0.67	3.1	U	3.1	1710		0.03
Equipment blank	J12XY5	7/27/06	0.07	U	0.07	9.5		2.4	0.26		0.01	0.67	U	0.67	1.0	U	1.0	2.3		0.03

Attachment	1	Sheet No	5 of 6
Originator	J. M. Capron	Date	11/13/06
Checked	T. M. Blakley	Date	
Calc. No.	0100C-CA-V0029	Rev. No.	0

Attachment 1. 100-C-9:1 (South) Verification Sampling Results.

Sample Location	Sample Number	Sample Date	Uranium			Vanadium			Zinc			Zirconium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
1	J12XV3	7/27/06	2.4	U	2.4	37.6		0.25	37.1		0.44	18.5		2.9
2	J12XV4	7/27/06	2.4	U	2.4	38.8		0.25	40.8		0.44	20.0		2.9
Duplicate of J12XV4	J12XY3	7/27/06	0.86	U	0.86	43.6		0.09	39.8		0.16	23.8		3.1
3	J12XV5	7/27/06	2.4	U	2.4	37.1		0.25	40.8		0.44	14.3		2.9
4	J12XV6	7/27/06	2.5	U	2.5	40.4		0.25	46.9		0.45	18.2		3.0
5	J12XV7	7/27/06	2.4	U	2.4	34.9		0.25	43.0		0.44	12.8		2.9
Duplicate of J12XV7	J12XY4	7/27/06	0.85	U	0.85	35.2		0.09	41.7		0.15	13.8		3.1
6	J12XV8	7/27/06	2.4	U	2.4	42.8		0.25	42.8		0.45	24.7		3.0
7	J12XV9	7/27/06	2.5	U	2.5	39.2		0.25	39.6		0.45	20.1		3.0
8	J12XW0	7/27/06	2.5	U	2.5	44.8		0.25	56.4		0.45	21.8		3.0
9	J12XW1	7/27/06	2.4	U	2.4	34.2		0.25	46.9		0.44	10.2		2.9
10	J12XW2	7/27/06	2.4	U	2.4	43.3		0.25	42.3		0.45	19.8		3.0
11	J12XW3	7/27/06	2.4	U	2.4	33.8		0.25	42.2		0.44	13.0		2.9
12	J12XW4	7/27/06	2.5	U	2.5	37.1		0.25	46.9		0.45	11.4		3.0
13	J12XW5	7/27/06	2.4	U	2.4	39.5		0.25	51.2		0.44	18.1		2.9
14	J12XW6	7/27/06	2.4	U	2.4	37.4		0.25	52.3		0.44	18.0		2.9
15	J12XW7	7/27/06	2.5	U	2.5	51.7		0.25	49.5		0.45	24.0		3.0
16	J12XW8	7/27/06	2.4	U	2.4	40.1		0.25	46.7		0.44	20.7		2.9
17	J12XW9	7/27/06	2.4	U	2.4	36.9		0.25	46.0		0.44	22.2		2.9
18	J12XX0	7/27/06	0.85	U	0.85	77.0		0.09	57.9		0.15	35.6		3.1
19	J12XX1	7/27/06	0.86	U	0.86	65.3		0.09	51.6		0.16	33.2		3.1
20	J12XX2	7/27/06	0.85	U	0.85	60.5		0.09	52.9		0.16	30.3		3.1
21	J12XX3	7/27/06	0.83	U	0.83	44.7		0.08	38.8		0.15	22.0		3.0
22	J12XX4	7/27/06	0.84	U	0.84	62.3		0.09	45.5		0.15	28.0		3.0
23	J12XX5	7/27/06	0.85	U	0.85	52.6		0.09	44.0		0.16	26.7		3.1
OB 7FF	J12XY1	7/31/06	0.85	U	0.85	44.8		0.09	39.4		0.15	22.1		3.1
BCL 8FF	J12XY2	7/31/06	0.84	U	0.84	46.6		0.09	42.4		0.15	20.2		3.0
OB 9FF	J12XX9	7/31/06	0.84	U	0.84	41.3		0.09	39.9		0.15	20.0		3.0
OB 10FF	J12XX7	7/31/06	0.85	U	0.85	43.2		0.09	38.3		0.15	21.3		3.1
BCL 11FF	J12XX8	7/31/06	0.85	U	0.85	46.9		0.09	39.5		0.15	22.9		3.1
BCL 12FF	J12XY0	7/31/06	0.83	U	0.83	54.6		0.09	41.7		0.15	25.5		3.0
OB 13FF	J12XX6	7/31/06	0.84	U	0.84	53.2		0.09	42.3		0.15	24.9		3.0
Equipment blank	J12XY5	7/27/06	0.85	U	0.85	0.09	U	0.09	0.69		0.15	1.0	U	1.0

Attachment	1	Sheet No	6 of 6
Originator	J. M. Capron	Date	11/13/06
Checked	T. M. Blakley	Date	
Calc. No.	0100C-CA-V0029	Rev. No.	0

APPENDIX D
DATA QUALITY ASSESSMENT

APPENDIX D

DATA QUALITY ASSESSMENT 100-C-9:1 MAIN PROCESS SEWER COLLECTION LINE

Confirmatory Sampling Data Quality Assessment

A data quality assessment (DQA) was performed to compare the confirmatory sampling approach and resulting analytical data with the sampling and data requirements specified in the site-specific sample designs (BHI 2003). This DQA was performed in accordance with site specific data quality objectives found in the *100 Area Remedial Action Sampling and Analysis Plan* (SAP) (DOE-RL 2005).

A review of the sample design (BHI 2003) and applicable analytical data packages has been performed as part of this DQA. All samples were collected per the sample design. To ensure quality data, the SAP data assurance requirements and the data validation procedures for chemical and radiochemical analysis (BHI 2000a, 2000b) are used as appropriate. This review involves evaluation of the data to determine if they are of the right type, quality, and quantity to support the intended use (i.e., closeout decisions). The DQA completes the data life cycle (i.e., planning, implementation, and assessment) that was initiated by the data quality objectives process (EPA 2000).

Confirmatory sample data collected at the 100-C-9:1 waste site were provided by the laboratories in six sample delivery groups (SDGs), SDG H2366, SDG H2372, SDG H2389, SDG H2397, SDG W04153, and SDG W04164. No major deficiencies were identified in the analytical data set. Minor deficiencies are discussed below.

The 100-C-9:1 waste site comprises multiple decision units. Samples from several decision units may compose any one SDG. Unless otherwise noted, deficiencies listed below are specific to the individual SDG, and apply to all samples within that SDG.

SDG H2366

This SDG comprises three field samples, one field duplicate pair (J00YP7/J00YR0), and one equipment blank (J00YP9). These samples were analyzed for inductively coupled plasma (ICP) metals, mercury, hexavalent chromium, polychlorinated biphenyls (PCBs), semivolatile organic analytes (SVOAs), sulfate, gross alpha and gross beta by proportional counting, and by gamma spectroscopy. No major deficiencies were found in SDG H2366. Minor deficiencies are as follows:

The relative percent differences (RPDs) for two radionuclides (gross alpha and gross beta) were above the acceptance criteria of 30%, at 111% and 35%, respectively. Elevated RPDs in environmental soil samples are attributed to natural heterogeneities in the soil matrix from which the sample and duplicate are prepared. The data are useable for decision-making purposes.

The common laboratory contaminant bis(2-ethylhexyl)phthalate was detected in the method blank (MB) at concentrations less than the contract required quantitation limit (CRQL). The data are not otherwise affected and are useable for decision-making purposes.

In the ICP metals analysis, the matrix spike (MS) recoveries for five ICP metals (calcium, chromium, mercury, antimony, and silicon) are out of the acceptance criteria. For antimony, the MS recovery was 69.6%, very close to meeting the criteria (70%). For calcium and mercury, the spiking concentration was insignificant compared to the native concentration in the sample from which the MS was prepared. For these analytes, the deficiency in the MS is a reflection of the analytical variability of the native concentration rather than a measure of the recovery from the sample. To confirm quantitation, post-digestion spikes (PDSs) and serial dilutions were prepared for all five analytes with acceptable results ranging between 91.0% and 108.9%. The analytes chromium and silicon did not have mismatched spike and native concentrations in the original MS. The results for these analytes may be considered estimated, however, the data are useable for decision-making purposes.

In the ICP metals analysis, the MB for boron is greater than the practical quantitation limit (PQL). Method blank contamination is considered significant when it is within 20 times a sample concentration. The sample concentrations are within the 20 times the MB concentration for boron. The values for boron may be considered estimated, however, the data are useable for decision-making purposes.

The RPDs calculated for calcium, lead, antimony, and silicon in the laboratory duplicate pair (sample J00YP7, and J00YP7 [duplicate]), are above the acceptance criteria with values of 42.6%, 84.4%, 77.2%, and 32.6%, respectively. Elevated RPDs in environmental soil samples are attributed to heterogeneities in the sample matrix and not to deficiencies in the analytical methodologies. The data are useable for decision-making purposes.

SDG H2372

This SDG comprises field sample J00YP2. This sample was analyzed for ICP metals, mercury, semivolatile organic compounds (SVOCs), PCBs, sulfate, alpha and gross beta by proportional counting, and by gamma spectroscopy. No major deficiencies were found in SDG H2372. Minor deficiencies are as follows:

For the SVOA analyses, the common laboratory contaminant bis(2-ethylhexyl)phthalate was detected in the MB at concentrations less than the CRQL. The data are not otherwise affected and are useable for decision-making purposes.

For the radionuclide analyses, the RPD for gross alpha was above the acceptance criteria of 30%, with a value of 131%. Elevated RPDs in environmental soil samples are generally attributed to natural heterogeneities in the soil matrix from which the sample and duplicate are prepared. The data are useable for decision-making purposes.

In the ICP metals analysis, the MB for boron is greater than the PQL. However, the sample result is greater than five times the MB concentration requirement for the program, and the data are useable for decision-making purposes.

In addition, the MS recoveries for eight ICP metals (aluminum, calcium, chromium, copper, iron, manganese, antimony, and silicon) are out of acceptance criteria. For most of these analytes, the spiking concentration was insignificant compared to the native concentration in the sample from which the MS was prepared. For these analytes, the deficiency in the MS recovery is a reflection of the analytical variability of the native concentration rather than a measure of method performance. To confirm quantitation, serial dilutions and PDSs were prepared for all eight analytes with acceptable results, in the range of 99.3% to 114.8% for the PDSs. Antimony and copper did not have mismatched spike and native concentrations in the original MS. The results for these analytes may be considered estimated, however, the data are useable for decision-making purposes.

SDG H2389

This SDG comprises field sample J00YP3. This sample was analyzed for ICP metals, mercury, SVOCs, PCBs, sulfate, alpha and gross beta by proportional counting, and by gamma spectroscopy. No major deficiencies were found in SDG H2389. Minor deficiencies are as follows:

For the SVOA analyses, the common laboratory contaminants di-n-butylthalate and bis(2-ethylhexyl)phthalate were detected in the MB at concentrations less than the CRQL. The data are not otherwise affected and are useable for decision-making purposes.

In the ICP metals analysis, the MS recoveries for nine ICP metals (aluminum, chromium, copper, iron, manganese, nickel, antimony, silicon, and zinc) are out of acceptance criteria. For most of these analytes, the spiking concentration was insignificant compared to the native concentration in the sample from which the MS was prepared. For these analytes, the deficiency in the MS recovery is a reflection of the analytical variability of the native concentration rather than a measure of the method performance. To confirm quantitation, PDSs and serial dilutions were prepared for all nine analytes with acceptable results, in the range of 87.6% to 132.6% for the post-digestion spike (PDS). Nickel and copper did not have mismatched spike and native concentrations in the original MS. The results for these analytes may be considered estimated, however, the data are useable for decision-making purposes.

The RPDs calculated for aluminum, boron, chromium, nickel, selenium, silver and silicon in the laboratory duplicate pair are above the acceptance criteria with values of 33.9%, 33.1%, 31.6%, 36.9%, 38.6%, 31.0%, and 55.0%, respectively. Elevated RPDs in environmental soil samples are generally attributed to heterogeneities in the sample matrix and not to deficiencies in the laboratory procedures. The data are useable for decision-making purposes.

SDG H2397

This SDG comprises field sample J00YP8. This sample was analyzed for ICP metals, mercury, SVOCs, PCBs, hexavalent chromium, alpha and gross beta by proportional counting, and by gamma spectroscopy. No major deficiencies were found in SDG H2397. Minor deficiencies are as follows:

For the SVOA analyses, the common laboratory contaminants di-n-butylphthalate and bis(2-ethylhexyl)phthalate were detected in the MB at concentrations less than the CRQL. The data are not otherwise affected and are useable for decision-making purposes.

In the radionuclide analyses, the RPD for gross alpha was 35%, and the RPDs for radium-228 and thorium-232 were both 65%: all above the acceptance criteria of 30%. Elevated RPDs in environmental soil samples are attributed to natural heterogeneities in the soil matrix from which the sample and duplicate are prepared. The data are useable for decision-making purposes.

In the ICP metals analysis, the MS recoveries for four ICP metals (aluminum, iron, manganese, and silicon) are out of acceptance criteria. For each of these analytes, the spiking concentration was insignificant compared to the native concentration in the sample from which the MS was prepared. The deficiency in the MS recovery is a reflection of the analytical variability of the native concentration rather than a measure of the method performance. To confirm quantitation, PDSs and serial dilutions were prepared for all four analytes with acceptable results, in the range of 95.9% to 104.9% for the PDS. The data are useable for decision-making purposes.

The RPD calculated for beryllium in the laboratory duplicate pair is above the acceptance criteria with a value of 30.5%. Elevated RPDs in environmental soil samples are generally attributed to heterogeneities in the sample matrix and not to deficiencies in the laboratory procedures. The data are useable for decision-making purposes.

SDG W04153

This SDG comprises field sample J00YP4. This sample was analyzed for hexavalent chromium. No major deficiencies were found in SDG W04153. Minor deficiencies are as follows:

In the hexavalent chromium analysis, it was noted that the sample solution was dark in color, which may have caused interference that resulted in a low MS recovery of 8%: outside the acceptance criteria. The LSC recovery and duplicate RPD are within the acceptance criteria. Hexavalent chromium will be retained for verification sampling.

SDG W04164

This SDG comprises field sample J00YP5. This sample was analyzed for hexavalent chromium. No major deficiencies were found in SDG W04164. Minor deficiencies are as follows:

In the hexavalent chromium analysis of sample J00YP5, the LCS and MS recoveries did not fall within acceptance criteria, at 15% and 21%, respectively. Hexavalent chromium will be retained for verification sampling.

FIELD QUALITY ASSURANCE/QUALITY CONTROL

RPD evaluations of main sample(s) versus the laboratory duplicate(s) are routinely performed and reported by the laboratory. Any deficiencies in those calculations were reported by SDG in the previous sections.

Field duplicate samples are collected to provide a relative measure of the degree of local heterogeneity in the sampling medium, unlike laboratory duplicates that are used to evaluate precision in the analytical process. The field duplicates that were collected at the 100-C-9:1 waste site (J00YP7/J00YR0) are reported in SDG H2366. The field duplicates are evaluated by calculating the RPD of the duplicate samples for each contaminant of concern (COC). Only analytes with values above five times the detection limits for both the main and duplicate samples are compared. The data are suitable for the intended purpose of cleanup verification.

Radionuclides. None of the RPDs calculated for radionuclide field duplicates are above the acceptance criteria (30%). The data are useable for decision-making purposes.

Nonradionuclides. The RPD calculated for hexavalent chromium is above the acceptance criteria (30%) at 73.9%. Elevated RPDs, such as these, in the analysis of environmental soil samples, are largely attributed to heterogeneities in the soil matrix and only in small part attributed to precision and accuracy issues at the laboratory. The data are useable for decision-making purposes.

RPDs for the remaining radionuclides and nonradionuclide analytes are not calculated because an evaluation of the data shows that the analytes are not detected in both the main and duplicate sample at more than five times the target detection limit. RPDs of analytes detected at low concentrations (less than five times the detection limit) are not considered indicative of the analytical system performance. The data are useable for decision-making purposes. A secondary check of the data variability is used when one or both of the samples being evaluated (main and duplicate) is less than five times the target detection limit (TDL), including undetected analytes. These results are attributed to heterogeneities in the sample matrix from which the samples were collected.

Summary

Limited, random, or sample matrix-specific influenced batch quality control (QC) issues, such as those discussed above, are a potential issue for any analysis. The number and types seen in these data sets are within expectations for the matrix types and analyses performed. The DQA review of the 100-C-9:1 confirmation sampling data found that the analytical results are accurate within the standard errors associated with the analytical methods, sampling, and sample handling. The DQA review for the 100-C-9:1 waste site concludes that the reviewed data are of the right type, quality, and quantity to support the intended use. Detection limits, precision, accuracy, and sampling data group completeness were assessed to determine if any analytical results should be rejected as a result of QA and QC deficiencies. The analytical data were found acceptable for decision-making purposes. Sample results reported for hexavalent chromium in SDG W04153 and SDG W0464 indicate that hexavalent chromium will need to be retained for verification sampling purposes. The confirmation sample analytical data are stored in the Environmental Restoration (ENRE) project-specific database prior to being submitted for inclusion in the Hanford Environment Information System (HEIS) database. The confirmation sample analytical data are also summarized in Appendix A of this document.

Northern 100-C-9:1 Verification Sampling Data Quality Assessment

A DQA was performed to compare the verification sampling approach and resulting analytical data with the sampling and data requirements specified in the site-specific sample designs (BHI 2005a). This DQA was performed in accordance with site specific data quality objectives found in the SAP (DOE-RL 2005).

A review of the sample design (BHI 2005a), the field logbook (BHI 2005b), and applicable analytical data packages has been performed as part of this DQA. All samples were collected per the sample designs. To ensure quality data, the SAP data assurance requirements and the data validation procedures for chemical and radiochemical analysis (BHI 2000a, 2000b) are used as appropriate. This review involves evaluation of the data to determine if they are of the right type, quality, and quantity to support the intended use (i.e., closeout decisions). The DQA completes the data life cycle (i.e., planning, implementation, and assessment) that was initiated by the data quality objectives process (EPA 2000).

Verification sample data collected at the northern 100-C-9:1 waste site were provided by the laboratories in two SDGs: SDG H3344 and SDG H3346. SDG H3344 was submitted for third-party validation. No major deficiencies were identified in the analytical data set: all of which is acceptable for decision-making purposes. Minor deficiencies, as well as third-party validation qualifiers, are discussed below.

SDG H3344

This SDG comprises twenty field samples (J03WX7 through J03OX9, J03WY0 through J03WY9, and J03X00 through J03X06) analyzed for hexavalent chromium, and the expanded ICP metals list, including lead and mercury. SDG H3344 was submitted for third-party validation. No major deficiencies were found in SDG H3344. Minor deficiencies are as follows:

In the metals analysis, the analytes silver, arsenic, barium, beryllium cobalt, chromium, manganese, molybdenum, nickel lead, selenium, vanadium, and zinc were detected in the MB at concentrations greater than the PQL. Most of these detections are insignificant compared to the detections in the field samples. Field sample detections that were not more than five times the method blank detections were qualified by third-party validation as estimated with “J” flags, as follows: silver and selenium in samples J03WY9, J03X04, and J03X06; arsenic and molybdenum in all of the SDG H3344 samples; and lead in sample J03WY7. Estimated data are useable for decision-making purposes.

Third-party validation qualified all results for antimony in SDG H3344 as estimated, with “J” flags, due to a 56.8% MS recovery. Estimated data are useable for decision-making purposes.

In the hexavalent chromium analysis the initial sample (J03WX7) was nondetected (0.20 mg/kg U) for hexavalent chromium while the duplicate sample was detected (0.28 mg/kg). The laboratory reported a RPD for the hexavalent chromium duplicate of 45.3%. This is above the acceptance criteria. However, because the values are at or near the detection limit, the calculation of RPD is an inappropriate method of evaluating method performance. Third-party

validation did not qualify the associated samples. The data are useable for decision-making purposes.

SDG H3346

This SDG comprises eight field samples (J03X07 through J03X14) analyzed for hexavalent chromium and the expanded ICP metals list, including lead and mercury. Sample J03X12 is the field duplicate of sample J03WX7. Sample J03X14 is the equipment blank for the northern 100-C-9:1 verification sampling. No major deficiencies were found in SDG H3346. Minor deficiencies are as follows:

The analytes barium, cobalt, manganese, and vanadium were detected in the MB at concentrations greater than the PQL. Most of these detections are insignificant compared to the detections in the field samples. The barium, cobalt, and vanadium results in sample J03X14 (the equipment blank) were the only results that were less than five times the method blank detections and may be considered estimated. Estimated data are useable for decision-making purposes.

In the metals analysis, the MS recoveries for the analytes antimony and manganese are out of criteria at 42.4% and 131.8%. This often occurs because the added spike concentration of an analyte is not well matched to the initial concentration of that analyte. This results in calculated MS recoveries that are indicative of the method performance. In these cases, the laboratory confirms method performance and quantitation by evaluating serial dilutions and post digestion spikes (PDSs). PDSs for antimony and manganese were 96.5% and 95.9%, respectively. The data are useable for decision-making purposes.

The laboratory duplicate results for the analyte molybdenum returned an RPD of 31.8%. This is just above the project acceptance criteria of 30%. Elevated RPDs are attributed to natural heterogeneities in the sample matrixes (soils) from which the primary and duplicate samples are derived. This result does not indicate a problem with the method performance or sample-handling procedures. The data are useable for decision-making purposes.

In the hexavalent chromium analysis, the initial sample (J03X13) was detected (0.30 mg/kg) for hexavalent chromium while the duplicate sample was nondetected (0.20 mg/kg U). The laboratory reported a RPD for the hexavalent chromium duplicate of 66.4%. This is above the acceptance criteria of 30%. However, because the values are at or near the detection limit, the calculation of RPD is an inappropriate method of evaluating method performance. The data are useable for decision-making purposes.

FIELD QUALITY ASSURANCE/QUALITY CONTROL

RPD evaluations of main sample(s) versus the laboratory duplicate(s) are routinely performed and reported by the laboratory. Any deficiencies in those calculations were reported by SDG in the previous sections.

Field QA/QC measures are used to assess potential sources of error and cross contamination of samples that could bias results. Field QA/QC samples, listed in the field logbook (BHI 2005b),

are summarized in Table D-1. The main and QA/QC sample results are presented in Appendix A.

Table D-1. Summary of Field Quality Control Samples.

Sample	Main	Duplicate
Northern 100-C-9:1 sample area 1	J03WX7	J03X12
100-C-9:1 middle suspect BCL stockpile	J03X10	J03X13
Equipment Blank	J03X14	--

Field duplicate samples are collected to provide a relative measure of the degree of local heterogeneity in the sampling medium, unlike laboratory duplicates that are used to evaluate precision in the analytical process. The field duplicates are evaluated by computing the RPD of the duplicate samples for each COC. Only analytes with values above five times the detection limits for both the main and duplicate samples are compared. The 95% upper confidence limit (UCL) calculation brief in Appendix C provides details on duplicate pair evaluation and RPD calculation. The data are suitable for the intended purpose of cleanup verification.

Nonradionuclides. None of the RPDs calculated for nonradionuclides field duplicates or splits were above the acceptance criteria. The data are useable for decision-making purposes.

RPDs, for the remaining analytes, were either within the acceptance criteria or were not calculated because an evaluation of the data shows the analytes were not detected in both the main and duplicate (or main and split) sample at more than five times the target detection limit. RPDs of analytes detected at low concentrations (less than five times the detection limit) are not considered indicative of the analytical system performance. The data are useable for decision-making purposes.

A visual inspection of all of the data is also performed. No major, or other minor, deficiencies were noted. The data are useable for decision-making purposes.

Summary

Limited, random, or sample matrix-specific influenced batch QC issues, such as those discussed above, are a potential issue for any analysis. The number and types found in these data sets were within expectations for the matrix types and analyses performed. The DQA review of the northern 100-C-9:1 verification sampling data found that the analytical results are accurate within the standard errors associated with the analytical methods, sampling, and sample handling. The DQA review for the northern 100-C-9:1 waste site concludes that the reviewed data are of the right type, quality, and quantity to support the intended use. Detection limits, precision, accuracy, and sampling data group completeness were assessed to determine if any analytical results should be rejected as a result of QA and QC deficiencies. The analytical data were found acceptable for decision-making purposes. The verification sample analytical data are stored in the ENRE project-specific database prior to being submitted for inclusion in the HEIS database. The verification sample analytical data are also summarized in Appendix B.

Southern 100-C-9:1 Verification Sampling Data Quality Assessment

A DQA was performed to compare the verification sampling approach and resulting analytical data with the sampling and data requirements specified in the site-specific sample designs (BHI 2006). This DQA was performed in accordance with site specific data quality objectives found in the SAP (DOE-RL 2005).

A review of the sample design (BHI 2006), the field logbooks (BHI 2005c, BHI 2005d), and applicable analytical data packages has been performed as part of this DQA. All samples were collected per the sample designs. To ensure quality data, the SAP data assurance requirements and the data validation procedures for chemical and radiochemical analysis (BHI 2000a, 2000b) are used as appropriate. This review involves evaluation of the data to determine if they are of the right type, quality, and quantity to support the intended use (i.e., closeout decisions). The DQA completes the data life cycle (i.e., planning, implementation, and assessment) that was initiated by the data quality objectives process (EPA 2000).

Verification sample data collected at the southern 100-C-9:1 waste site were provided by the laboratories in three SDGs: SDG K0512, SDG K0513, and SDG K0591. SDG K0513 was submitted for third-party validation. No major deficiencies were identified in the analytical data set: all of which is acceptable for decision-making purposes. Minor deficiencies, as well as third-party validation qualifiers, are discussed below.

SDG K0512

This SDF comprises seventeen field samples (J12XV3 through J12XV9, and J12XW0 through J12XW9) analyzed for hexavalent chromium, and the expanded ICP metals list including lead and mercury. No major deficiencies were found in SDG K0512. Minor deficiencies are as follows:

In the ICP metals analysis, a quality control check of the continuing calibration verification sample revealed that the sample did not meet the acceptance criteria for some of the analytes. The samples were rerun. A third analysis of the samples was also performed with dilution to overcome high concentrations of non-target analytes. The final data reported by the laboratory is a mixture of the three analyses, in order to get the best results for each analyte. The data are useable for decision-making purposes.

The LCS was reported with a low recovery for the analyte silicon (47.5%). Silicon is not a contaminant of concern or a potential contaminant of concern for the 100-C-9:1 waste site. The low recovery may indicate a low bias in the silicon data reported in this SDG. Those results are considered estimated. Estimated data are useable for decision-making purposes.

The MS recoveries for nine analytes (aluminum, calcium, iron, magnesium, manganese, antimony, titanium, silicon and mercury) were found to be outside of the acceptance criteria in the ICP metals analysis. Comparison of the added MS concentrations to the initial concentrations found in the sample showed that these concentrations were not well matched for all nine of these analytes. The results are, therefore, not a good indication of the method

performance. The laboratory response to this situation is to confirm the method performance and quantitation of these analytes using serial dilutions and post-digestion spikes (PDSs)*. The PDS results were all within the range of 87.5% to 104.1%. The data are useable for decision-making purposes.

SDG K0513

This SDG comprises sixteen field samples (J12XX0 through J12XX9, and J12XY0 through J12XY5) analyzed for hexavalent chromium and the expanded ICP metals list, including lead and mercury. SDG K0513 was submitted for third-party validation. No major deficiencies were found in SDG H0513. Minor deficiencies are as follows:

In the same manner as described for SDG K0512, the samples were analyzed for ICP metals three times. The final data set is a mixture of those three runs. The data are useable for decision-making purposes.

The LCS was reported with a low recovery for the analyte silicon (32.6%). Silicon is not a COC or a potential COC for the 100-C-9:1 waste site. The low recovery may indicate a low bias in the silicon data reported in this SDG. Third-party validation qualified all of the silicon results in SDG K0513 as estimated with "J" flags added to the data. Estimated data are useable for decision-making purposes.

The MS recoveries for six analytes (aluminum, calcium, iron, antimony, silicon, titanium) were found to be outside of the acceptance criteria in the ICP metals analysis. Serial dilutions and PDSs were performed to confirm method performance. The PDS results were all within the range of 74.0% to 102.5%. However, due to the initial MS results, third-party validation qualified all of the antimony and calcium results in SDG K0513 as estimated, with "J" flags added to the data. Estimated data are useable for decision-making purposes.

SDG K0591

This SDG comprises two field samples (J13H30, J13HF3) analyzed for hexavalent chromium. No major or minor deficiencies were found in SDG K0591.

FIELD QUALITY ASSURANCE/QUALITY CONTROL

Relative percent difference (RPD) evaluations of main sample(s) versus the laboratory duplicate(s) are routinely performed and reported by the laboratory. Any deficiencies in those calculations are reported by SDG in the previous sections.

Field QA/QC measures are used to assess potential sources of error and cross contamination of samples that could bias results. Field QA/QC samples, listed in the field logbook (BHI 2005d), are summarized in Table D-2. The main and QA/QC sample results are presented in Appendix A.

*For the analyte mercury no PDS is performed; the serial dilution is used to confirm method performance.

Table D-2. Summary of Field Quality Control Samples.

Sample	Main	Duplicate
Southern 100-C-9:1 sample area 2	J12XV4	J12XY3
Southern 100-C-9:1 sample area 5	J12XV7	J12XY4
Equipment Blank	J12XY5	--

Field duplicate samples are collected to provide a relative measure of the degree of local heterogeneity in the sampling medium, unlike laboratory duplicates that are used to evaluate precision in the analytical process. The field duplicates are evaluated by computing the RPD of the duplicate samples for each COC. Only analytes with values above five times the detection limits for both the main and duplicate samples are compared. The 95% UCL calculation brief in Appendix B provides details on duplicate pair evaluation and RPD calculation. The data are suitable for the intended purpose of cleanup verification.

Nonradionuclides. None of the RPDs calculated for nonradionuclides field duplicates or splits were above the acceptance criteria. The data are useable for decision-making purposes.

RPDs, for the remaining analytes, were either within the acceptance criteria or were not calculated because an evaluation of the data shows that the analytes were not detected in both the main and duplicate (or main and split) sample at more than five times the target detection limit. RPDs of analytes detected at low concentrations (less than five times the detection limit) are not considered indicative of the analytical system performance. The data are useable for decision-making purposes.

A secondary check of the data variability is used when one or both of the samples being evaluated (main and duplicate or main and split) is less than five times the TDL, including undetected analytes. In these cases, a control limit of ± 2 times the TDL is used (Appendix C) to indicate that a visual check of the data is required by the reviewer. None of the analytes in the 100-C-9:1 south data needed further review based on this check of the data. The data are useable for decision-making purposes.

A visual inspection of all of the data is also performed. No major, or other minor, deficiencies were noted. The data are useable for decision-making purposes.

Summary

Limited, random, or sample matrix-specific influenced batch QC issues such as those discussed above, are a potential issue for any analysis. The number and types found in these data sets were within expectations for the matrix types and analyses performed. The DQA review of the southern 100-C-9:1 verification sampling data found that the analytical results are accurate within the standard errors associated with the analytical methods, sampling, and sample handling. The DQA review for the southern 100-C-9:1 waste site concludes that the reviewed data are of the right type, quality, and quantity to support the intended use. Detection limits,

precision, accuracy, and sampling data group completeness were assessed to determine if any analytical results should be rejected as a result of QA and QC deficiencies. The analytical data were found acceptable for decision-making purposes. The verification sample analytical data are stored in the Environmental Restoration (ENRE) project-specific database prior to being submitted for inclusion in HEIS. The verification sample analytical data are also summarized in Appendix B.

References

- BHI, 2000a, *Data Validation Procedure for Chemical Analysis*, BHI-10435, Rev. 0, Bechtel Hanford, Inc., Richland, Washington.
- BHI, 2000b, *Data Validation Procedure for Radiochemical Analysis*, BHI-01433, Rev. 0, Bechtel Hanford, Inc., Richland, Washington.
- BHI, 2003, *Waste Site Evaluation for 100-C-9:1 Main Process Sewer (Twin Box Sewer)(100-C-9 Process and Sanitary Sewer Underground Pipelines)*, 0100B-CA-V0183, Rev. 0, Bechtel Hanford, Inc., Richland, Washington.
- BHI, 2005a, *Work Instruction for Verification Sampling of the Northern Portion of the 100-C-9:1 Main Process Sewer Pipeline (Twin Box Culvert)*, 0100B-WI-G0006, Rev. 0, Bechtel Hanford, Inc., Richland, Washington.
- BHI, 2005b, *Remaining Sites Field Sampling*, Logbook EFL-1173-6, Bechtel Hanford, Inc., Richland, Washington.
- BHI, 2005c, *Remaining Sites Field Sampling*, Logbook EFL-1585-6, Bechtel Hanford, Inc., Richland, Washington.
- BHI, 2005d, *Remaining Sites Field Sampling*, Logbook EL-1585-7, Bechtel Hanford, Inc., Richland, Washington.
- BHI, 2006, *Work Instruction for Verification Sampling of the Southern Portion of the 100-C-9:1 Main Process Sewer Pipeline (Twin Box Culvert)*, 0100B-WI-G0018, Rev. 0, Bechtel Hanford, Inc., Richland, Washington.
- DOE-RL 2005, *100 Area Remedial Action Sampling and Analysis Plan*, DOE/RL-96-22, Rev. 4, U.S. Department of Energy, Richland Operations Office, Richland, Washington.
- EPA, 2000, *Guidance for Data Quality Assessment*, EPA QA/G-9, QA00 Update, U.S. Environmental Protection Agency, Office of Environmental Information, Washington, D.C.